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Vol. 3—No. 2

THE PAPER INDUSTRY

A. SCOTT DOWD
Editor

A MONTHLY EDUCATIONAL JOURNAL
Devoted to the Interests of the Pulp and Paper Industry

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EDITORIAL

Abolish Waste

THE subject of industrial waste has been the center of attraction ever since the world conflict has made it necessary to buckle down and bring us back to a normal condition through the medium of production. Our great engineers are continually applying themselves to this problem in their endeavor to establish a broadcast understanding of the fact that efficiency is after all but another name for "elimination of waste." In order to meet the present situation of falling prices and lessening demand, every paper manufacturer must devote his time to increasing production, and the distribution of his product at a lower cost, but with profitable results.

Improved methods of handling materials, new mechanical devices designed to increase the output, more economical practice in the laboratory, and ways of determining the cost of manufacture and a corresponding knowledge of how to eliminate waste in production are constantly being published in the columns of this journal. By so doing the reader is continually being informed of pitfalls in the industry, the hidden traps of waste, and how to avoid them.

In a recent address by Herbert Hoover, Secretary of Commerce, delivered before a body of engineers, his remarks showed pointedly that the elimination of waste has a solution through the channels of industrial advertising.

Moreover, he said, "Our studies of industries as a whole show that we usually expand our equipment just at the periods of maximum demand for our products instead of doing our plant expansion during periods of slack consumption. We thus make double demands on labor and we doubly increase unemployment in periods of reduced consumption."

Through industrial advertising, ways are shown to overcome the wastes that we know exist. The skill and ingenuity of trained engineers and mechanics are being constantly employed in attaining that efficiency by which is obtained the greatest number of productive units in a given time and the reduction of waste to a minimum. A study of the advertisements as they appear from month to month in this journal is especially recommended. The papermaking of today becomes ancient history as each succeeding year passes by, and the successful firm and individuals in it are those who keep abreast of the times and in periods of slack demand fit themselves to become more efficient and eliminate waste.

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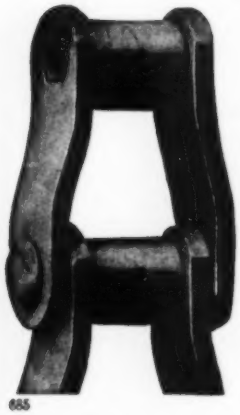

THEY fit each other snugly. There is no sliding or slipping as the links seat themselves against the teeth. And they continue to fit each other snugly, because the flint hard surfaces prevent wear.

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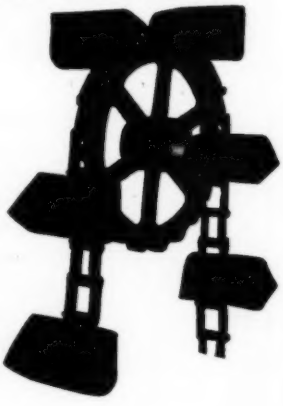
This trade mark >——< identifies Link-Belt products



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EDITORIALS

"Keep On Keepin' On"

ONE of Chicago's daily papers has succeeded in nationalizing their slogan, "1921 will reward fighters." Many of the other papers have commented on this and some of the more widely circulated ones have published lengthy articles containing daily analyses of its psychological aspects.

As a slogan for this year of trials and tribulations resulting from the readjustment of economic conditions as a result of our recent war it is especially apropos. Something like it was needed to emphasize and visualize the need of the combative spirit to carry us over the bad days into which we have fallen.

It is true, however, that every year has rewarded fighters and will continue to do so. Not the truculently inclined, it is true, who go about with a chip on their shoulder looking for trouble, but the steadfast forward striver who can sense the need of determined effort to "carry on" and who stubbornly aims to oppose the bad conditions by greater activity along constructive lines.

In business, as in all fields of human endeavor, the gonfalon is not to the brilliantly gifted alone. He who, with his mind and spirit ever fixed upon the crested goal, "keeps on keepin' on," will also succeed.

The paper manufacturer, or any other man in the industry, who sits in his chair awaiting the return of good times, will not have very much business during 1921, but the man who works a little harder this year because business is harder to secure and who constantly fights for that which he is entitled to, will be rewarded in 1921 as in all other years.

A Sign of the Times

THERE are many indications that conditions are slowly improving in most of the industries, and this is true in the manufacture of paper as well as that of any other commodity. In a letter written several weeks ago by a prominent manufacturer in another line, he stated that 90% of all the business in his industry was handled by twenty-eight firms, and in pointing out the sad condition of their industry, wrote that as compared with 100% in January, 1920, the figures showed that these companies had done 23% in February of this year. However, he stated that in March of this year the production was 32%, meaning that while in February it was less than one-fourth of normal, in March it was nearly one-third, but that the increase from February to March was tremendous. If this same proportion of increase occurred in April over March, these figures would indicate that everything was going in the right direction.

Another indication of showing which way the wind is blowing is the story telling of the opening of the automobile factories, as well as the plants in a number of other industries which had been closed for some time, or that had been working with only a small percentage of their normal force

Knowing the Cost Is Necessary

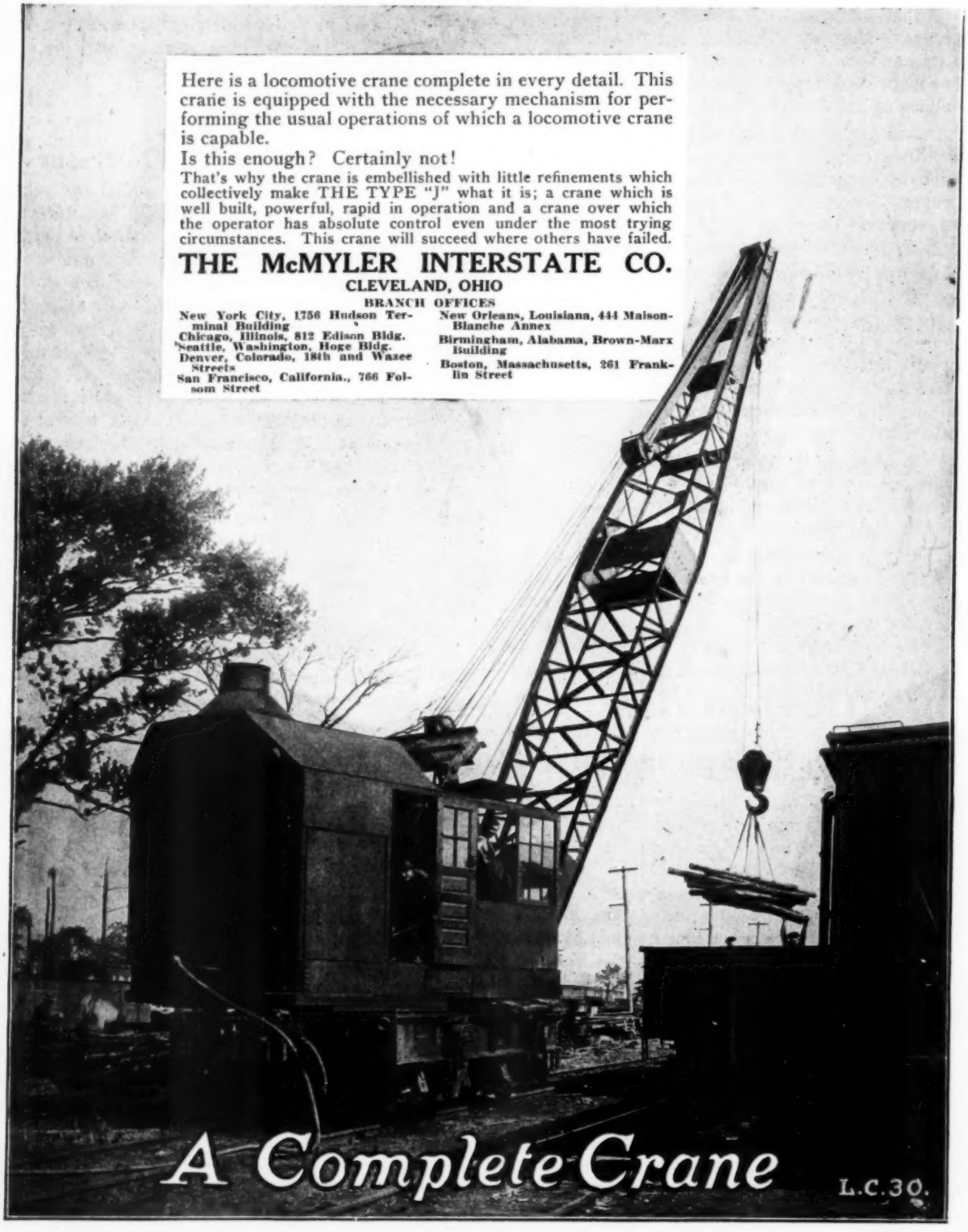
IT SHOULD not be necessary to remind any paper manufacturer that it is necessary to determine the cost of manufacturing goods before a proper selling price can be ascertained, and yet there was a time well within the memory of most men in the industry when practically every paper manufacturer sold his product without an adequate knowledge of what it cost to produce it, and consequently with more or less success. There are still many paper mills that do not have adequate cost systems, and it often seems to one on the outside that if the balance at the end of the year is on the right side of the ledger, this is all that is necessary to satisfy some manufacturers with the year's business.

Some men are born merchants, but unfortunately all manufacturers of paper are not in this class. Most of these men are hard-headed, practical business men who know how to manufacture paper, but we are sure that those who have come down to the use of proper cost finding systems, and know what it costs to turn out each order, and base their selling price on such cost, are more sure of making a reasonable profit than if it is done in any other way. The only true system for success in this or any other business is an accurate knowledge of the cost of production, and a sales policy which results in selling production at a higher figure than its cost. These two fundamental points must be interlocked and operated together if a profit is to be consistently had.

THE PAPER INDUSTRY has published so many articles on the advantage of cost finding that we are sure our readers must see the advantages of such system at this time. However, there is, no doubt, considerable room for improvement in the best of systems and as time goes on each manufacturer ought to be able to have a more effective system than that which is in use today. The Cost Association of the Paper Industry and many of the men connected with this Association have done fine work in telling of the needs for real cost finding, and we know that this effort has been of great benefit to many of the manufacturers of paper.

When people see chips on a man's shoulder they are likely to think they fell from a blockhead.

Latest Development in Locomotive Cranes for Handling Coal, Pulp Wood, Etc.


Here is a locomotive crane complete in every detail. This crane is equipped with the necessary mechanism for performing the usual operations of which a locomotive crane is capable.
Is this enough? Certainly not!
That's why the crane is embellished with little refinements which collectively make THE TYPE "J" what it is; a crane which is well built, powerful, rapid in operation and a crane over which the operator has absolute control even under the most trying circumstances. This crane will succeed where others have failed.
THE McMYLER INTERSTATE CO.
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Chicago, Illinois, 812 Edison Bldg.
Seattle, Washington, Hoge Bldg.
Denver, Colorado, 18th and Wazee Streets
San Francisco, California., 766 Folsom Street
New Orleans, Louisiana, 444 Maison-Blanche Annex
Birmingham, Alabama, Brown-Marx Building
Boston, Massachusetts, 261 Franklin Street
A Complete Crane
L.C.30.

Business Education

By R. L. S.

THE art of getting a living will some day be more of a pleasure than it is at present. When men learn that graciousness is the one lubricant of character able to smooth out the wrinkles in the forehead of humanity, they will find that grace is not wasted between capital and labor, but does apply the same anti-friction qualities to business that a master mechanic finds the finest lubricant brings to mechanism.

The Nazarene prophet who brought a new educational process to the attention of the world two thousand years ago, understood a great deal about the necessities of business life. Were He among us today it might easily be that He would feel more at home in the modern business institution run on democratic lines than in the ecclesiastical institution we have been taught was a church. When He gave out the greatest mode ever introduced to modify humanity's problems, He did it in simple words, saying, "Ye shall know the truth, and the truth shall make you free."

The time is long since past when problems in business life can be worked out in the dark. The advertising men of the country, a body of practical thinkers, have found the slogan "Truth in advertising" profitable in application. Even the best sentiment in an honest individual must square with arithmetic, if it is to be a success. There have been altogether too many exponents of fantastic propaganda propelled by enthusiasm, a zeal to do without any accurate program or well focused design as to just the eventual result desired. A nervous reformer is mere bait for the lions.

Under the old competitive system of working, cupidity was the hub around which the progress of successful business seemed to rotate. Men standing today for the new success, a success having more than one dimension, money — these men will tell you frankly that even on the basis of self interest the higher viewpoint is the more mathematical route to actual achievement.

The enlistment of an army of workers wi h a given aim demands the same loyalty that marks a successful regiment on the battle field of Europe. Men should learn a lesson from the recent war, applicable to the busy marts of trade. At an important point in a seemingly hopeless struggle, something happened. There were millions enough devoting their best energy to winning the struggle to have brought victory, had mere numbers been adequate to the task. But there was a lack of Principle. The nations of Europe, apart from self interest had no live question to decide. It was a question merely "who shall be greatest?"

But when the avalanche of a freeborn country struck the battle line, acting from absolutely disinterested motives, autocratic selfishness broke ranks because they lacked either the underpinning or understanding essential to meet the maneuvers of unfettered minds unbound by dominant rulers.

Let the men of sterling fibre in the business world, and there are plenty of them apart from the money mad, let them actually get down to seek the TRUTH about the present needs of their fellows, not mere moral justice, but generous care for the ones unable to care for themselves. The lurid RED and YELLOW streak in human experience can be best extinguished by the HONEST WHITE.

1896 1921

Our Silver Anniversary

was celebrated last month, and our one aim during all of these years has been to build **Service** and **Satisfaction** into every wire that has gone out of our plant.

That fact that we have had to double and treble our plant and output in recent years, proves that we have attained these aims, at least to some degree. Every thought for the future, however, is based on the same proposition. These are some of the reasons why

"Appleton Wires Are Good Wires"

APPLETON WIRE WORKS
APPLETON, WIS.

1896 1921

$300.00 for an Article

Received Between October 1, 1920, and September 30, 1921

THE PAPER INDUSTRY was started with the one idea of being helpful to the whole Pulp and Paper Manufacturing Industry. We believe we have succeeded. At least many people tell us so, but we want to do more in being helpful, so that every man in the industry may know more of his chosen work.

Many men in this industry have valuable ideas that would be worth hundreds, possibly thousands of dollars, for other men to know, and at the same time will not harm the one man that knows it. The old idea of hiding our light under a bushel for fear someone else will learn of something that we may know has passed, and the war was to a large degree responsible for this. It is stated that America advanced more in most of the arts and sciences, as well as manufacturing processes, in the few years of the war period, than it had in fifty years before.

We lose nothing by giving out knowledge. If each of two men have a dollar and each gives his to the other, both will have the same and gain nothing, but if each of two men have an idea, and each gives away that which he has, he does not lose, but each has two, and so if we multiply this by one hundred or a thousand, each man that formerly had only one idea, now has a hundred or thousand, and no one has lost.

So, in order that the greatest number may have the greatest amount of knowledge, and in order to get men to take the time for the proper study and preparation of the right kind of an article, we will give to those who will endeavor to furnish us with real helpful articles, during the next twelve months, the following amounts:

For the best article furnished in this competition, we will give the sum of $300.00.
For the second best article we will pay $100.00.
For the third best article we will pay $50.00.
For the fourth best article we will pay $25.00.
For the fifth best article we will pay $15.00.
For the next thirty-one best articles, we will pay $10.00.
For the next forty best articles we will pay $5.00.

Any one man may write as many articles as he desires, providing they are on different subjects. Each article, however, should fill at least three pages of THE PAPER INDUSTRY.

Several well known men of the industry will be chosen as judges in this competition, their names to be announced at a later date, and the publisher of THE PAPER INDUSTRY will only decide first whether the article is worthy of publishing at all, and if so, then it will take its chance for the $300.00 prize.

In order to make it possible to publish these papers during the next twelve months, papers must begin to come in immediately and the minimum price of $5.00 will be paid for each as they are published, the balance representing the prize money will be awarded after the twelve months period has expired, and the decisions have been made.

Some men feel that they know many good things, but cannot write them down in proper fashion. It will not be necessary that these articles be written to show any great amount of learning, as many men who have had little schooling may be able to furnish the most helpful ideas, and it is something that is helpful that we want; we have an editor for the very purpose of carefully scrutinizing everything before it goes to the printer, so that it may be grammatically and typographically correct.

You can choose your own subject, as there are so many things to be written about in this great industry that we will not even attempt to outline the full list of subjects, but it may be of some plan to get a larger product out of a machine; it may be on the subject of saving in the power plant; saving bleach, dye, or one of many other things; it may be a plan to make the wire or felt last longer; some method of making a better sheet without increasing the cost, or making as good a sheet by reducing the cost; a new idea in the process of pulp making; in fact it can be on any subject that will be helpful to pulp and paper manufacturers, and their employes.

Anyone can try his hand, be he president, manager, superintendent, chemist, engineer, machinery man, foreman, or workman. If some one should feel they cannot write a long article, then write a short one. We will pay for it, if we can use it.

Start NOW and get your article or articles in at the earliest possible time.

Address all articles in this competition to

"Contest,"
THE PAPER INDUSTRY,
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JEFFREY
MATERIAL HANDLING MACHINERY

The Relation of the Moisture Content of Wood to Its Decay

With Special Reference to the Spraying of Log Piles

By WALTER H. SNELL

Assistant Professor of Botany, Brown University; Formerly Forest Pathologist, U. S. Dept. of Agriculture

THE prevention of fire in piles of pulp wood by means of artificial fog has been advocated recently by F. J. Hoxie[1]. The idea is, of course, to keep the wood wet enough to prevent its catching fire. But while the log piles are being protected from fire a question naturally arises: is this wetting of the logs going to bring about conditions favorable to decay and thus cause as much loss as, if not more than, what is now caused by fire?

The growth of the wood-destroying fungi in wood is dependent upon a certain amount of moisture and of oxygen, granting that these fungi have a favorable food to grow upon and a favorable temperature. The amounts of moisture and air within the wood are directly related one to the other. Wood is made up of cells which are hollow, the hollow portions or lumina being large or small according to the density of the wood. Hence, in a light wood like spruce (figure 1) we find the walls thin and the empty spaces within the walls (the lumina) rather large. While in a hard pine (figure 2) the walls are thick and solid and the lumina correspondingly smaller. These lumina of the wood cells may contain either water or air, and it is clear that those portions not filled with water will have air in them and vice versa. If water is forced into the wood air will be forced out, and if water is withdrawn from the wood air will enter.

As already mentioned, the growth of fungi within wood is dependent upon a proper amount of air and moisture—which means a proper balance between the air and moisture supply within the wood. If too little moisture is present fungi cannot grow for the lack of it. If large percentages of water are present in the wood fungi cannot grow, not because there is too much water, but because there is too little air. In other words, a fungus will drown under water, where it cannot get air, no less than a man will. Drowning of plants and animals is essentially asphyxiation. Between the two limits where there is too little moisture to support fungus growth and where there is too little air because of its displacement by water, there is a wide zone where growth is possible, and a certain peak in the curve where conditions of air and moisture are at the optimum. It is important to know just what relation exists between the moisture and air content of pulp logs which are constantly sprayed as mentioned above and the three cardinal points (minimum, optimum and maximum points of growth) in the air-moisture curve of wood-destroying fungi.

The purpose of this article is to reveal what is thus far known regarding the air and moisture relations of fungi which decay wood. The data are taken from a paper published in Germany by Muench[2] and from preliminary experiments made by the writer. The

Figure 1—Cross section of spruce, a light wood, showing relatively small amount of wood substance and large lumina, which may contain air or water. Photograph by F. J. Hoxie

German writer performed an extended series of experiments upon the fungi which cause the sap-staining or blue-staining of sap lumber, and also upon several fungi which decay wood. In general, he found that none of the fungi of either group could invade fresh (that is, green) sap wood which contained 59 per cent of water (equivalent to 143 per cent of water calculated on the oven dry weight of the wood). As the wood was dried, however, it was found that the fungi invaded the wood more deeply and did more damage the drier the wood, up to a certain limit.

Table I shows the results of Muench's experiments upon the moisture relations of one of the sap-stain fungi (**Ceratostomella coerulea**) in the sap wood of Scotch pine. In columns 2 and 3 the results are given on the basis of air volume and the volume of water within the cell cavities (exclusive of the water in the

[1]F. J. Hoxie. Fire Prevention in Pulpwood by Means of Artificial Fog. The Paper Industry, January, 1921.

[2]Muench, E. Untersuchungen ueber Immunitaet und Krankheitsempfaenglichkeit der Holzpflanzen. Naturwissenschaftliche Zeitschrift fuer Forst.—und Landwirtschaft 7:54.

cell walls themselves) on the basis of 100 cubic centimeters of wood. In column 5 of the table Muench's figures are translated into the engineers' terms of percentage of water determined upon the basis of

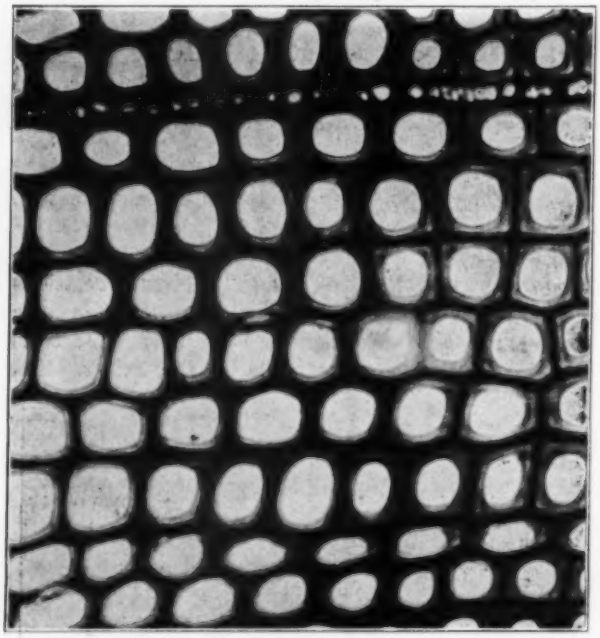


Figure 2—Cross section of jack pine, a medium heavy wood, showing relatively large amount of wood substance in the thick walls and smaller amount of air and water space. Compare with spruce in figure 1. *Photograph by F. J. Hoxie*

the total weight of the wet log. Column 6 gives the figures in terms of water over and above the oven dry weight of the wood. It is seen from the bottom of column 5 that 23 per cent of water allowed very little penetration (or staining) of the wood by the fungus, that from 25 up to 42 per cent of water allowed, the maximum amount of staining, and from there up to 54 per cent there was a gradual decrease in fungus growth and none at all at 59 per cent. Column 2 shows that for the most favorable growth of this fungus within wood there must be a quantity of air equivalent to about half the volume of the block (42 to 59 cubic centimeters in 100). Muench did not give figures for the growth of the true wood-destroying fungi, but showed that in general the same figures given for the sap-stain fungi held true for the wood destroyers. He did not, however, point out that these percentages hold only for woods of about the same density as those he used and that they do not apply to lighter or heavier woods.

Table I. Data obtained by Muench upon the relation of the growth of a sap-stain fungus **(Caratostomella coerulea)** to the moisture and air supply in Scotch pine sap wood.

	Results as tabulated by Muench on basis of 100 ccm. of wood			Results shown as moisture per cent of total weight of wet wood	Results in terms of water above oven dry weight of wood
	1	2	3	4	5	6
Block	Air in wood ccm.	Volume of free water above fiber saturation ccm.	Penetration and staining by fungus	%	%
1	15	45	none	59	143
2	23	35	little	54	119
3	25	32		52	111
4	36	24		48	92
5	38	22		47	88
6	40	18		44	78
7	42	16	optimum	42	74
8	47	11	for	38	62
9	54	4	growth	31	45
10	55	5	of	31.6	46
11	59	—1	fungus	25	33
12	61	—3		23	28

In order to check up Muench's figures and to get more exact data for the latter class of fungi the present writer started some experiments in the Department of Botany at Brown University upon the moisture relations of five of the fungi found decaying structural timbers in New England cotton mills[3]. The fungi are: **Lenzites sepiaria, Lenzites trabea, Trametes serialis, Fomes roseus** and **Lentinus lepideus.** The first four of these are found quite commonly on pulp logs. Two woods of different densities were used in the tests—loblolly pine sap weighing 27.5 pounds to the cubic foot, and Sitka spruce weighing about 22 pounds (specific gravities of .44 and .35 respectively). Only one series of tests has thus far been completed, but the results obtained are of value in the present discussion upon the spraying of pulpwood and the question of decay in the wet piles. Further experiments upon this relation between decay and the moisture content of wood, especially the relation of the density of the wood to the moisture-decay curve, are still in progress.

The results upon the loblolly pine sap are very closely in line with those of the German writer on Scotch pine. There was found to be very little decay when the amount of water was below the fiber saturation point (25 per cent in terms of the oven dry weight of the wood), but with increase of moisture content the decay became more extended. The greatest amount of decay occurred between 33 per cent and 42 per cent. From 42 per cent on the amount decreased. At 50 per cent there was little decay and none at 60 per cent.

Conditions were different with the spruce, a lighter wood. Penetration and decay by the fungi began a little below the fiber saturation point for this wood and increased in amount with higher percentages of moisture. The greatest amount was between 30 and 57 per cent. There was no penetration by the mycelium and decay at 67 per cent. It is seen that

[3]A study of these fungi carried on by the writer at the Forest Products Laboratory at Madison, Wisconsin, is soon to appear as a Bulletin published by the United States Department of Agriculture.

the latter values are higher for the spruce than for the pine sap. Obviously the values representing the upper moisture limits for decay will vary inversely with the density of the wood.

With reference to the decay of pulpwood, however, the figures on Sitka spruce represent an extreme case, for this wood is lighter than any of the pulp woods. Table II shows that the Sitka spruce used weighed 22 pounds to the cubic foot, while poplar, balsam and red spruce weigh 26 to 27 pounds, or very near the density of the pine sap used. Hence, the figures on the relation of moisture content to decay of the loblolly pine sap will be applicable to the pulp woods.

Table II. Densities of a few common woods, including some woods used in making pulp.

	Density (pounds per cubic foot, oven dry)	Specific gravity (weight and volume, oven dry)
White oak	44	.71
Sweet birch	43	.70
Sugar maple	41	.66
Longleaf pine	40	.64
Paper birch	38	.60
Pitch pine	34	.54
Loblolly pine sap*	28	.44
Cottonwood	27	.43
Balsam	26	.41
Red spruce	26	.41
Sitka spruce*	22	.35

*These two woods were the ones used in the tests quoted.

In a recent article Sutermeister[4] reports that spraying a pile of poplar logs for a short period resulted in the pulp bolts taking up water to the amount of 52 to 60 per cent. The logs sprayed as he described were covered with molds and slime molds, were nearly black in color and had the appearance of being badly decayed. Examination proved, however, that "the greater part of the wood was sound and very few logs could be found which were soft enough to allow a knife to be driven into them more than a quarter of an inch."

If spraying a pile of logs for a few months added 52 to 60 per cent of water, continuous spraying over longer periods would increase the amount of water. The writer's experiments with five different fungi, four of which occur upon pulpwood, show that 60 per cent of water in the logs will eliminate all danger of serious loss from decay. These results should enable pulp mill owners to proceed with confidence in the installation of a spray system such as advocated by Hoxie. A constant spray or "artificial fog" will keep the logs sufficiently wet to protect them from both fire and decay. Logs so wet will mold on the outside, but molds do no damage to wood beyond discoloring it superficially.

[4]Sutermeister, E. Spraying Wood for Preservation and Fire Protection. Paper, Dec. 22, pp. 21 and 30. 1920.

Turning Laboratory Theory Into Profit-Making Practise*

Difference Between Molds and Wood Destroyers

By F. C. CLARK
Director of Department of Technical Control, American Writing Paper Company

Are your processes petrified? How long since they have been audited? Mr. Clark hatches improvements in four stages, from the test-tube to experimental life-size manufacture in a complete mill belonging to the laboratory, then transplants these methods to 26 mills. He has developed the technical department in the same way, starting in a small way and turning "practical" shop men from obstructors into co-operators.

MANY plants wish to formulate and issue from a central technical department all technical data regarding plant operations just as cost methods or material specifications are now issued. The obstacle is the supposed reluctance of the shop men to work well with anyone who tries to tell them about a trade they have known all their lives. In our company this old feeling of prejudice is now rapidly changing to one of heartiest co-operation. A description of the methods used in bringing about this change will interest others who may be trying to secure the co-operation of the mill operatives.

The question is often asked: Why tie up the laboratory idea directly to the factory instead of leaving it at the university? And the answer is that university scientists fail to make the contact between theory or fact and the application of that fact in useful or at least profitable practice. A factory can use only the scientific facts which can be hitched up to make a profit. The manufacturing scientist, therefore, must

*Reprinted from and illustrations loaned through the courtesy of Factory.

get the factory atmosphere, and the only way he can do that is to be at the factory. And, too, he wishes to give the factory his atmosphere, and for that he must be in the factory among the men.

There are two great obstacles to the introduction of an engineering or technical control department—

WHERE THE HAND METHOD IS STILL GOOD

It does not pay to run big batches of paper for each new formula that is tried. The ancient hand method of paper making is used for the test-tube stage in the laboratory of the American Writing Paper Company

iron-bound methods, and iron-headed men. Petrified methods have been long established in many industries; a man used to them is unable to think except in terms of them. The only improvement he dreams of is some slight departure which bears the same relation to the old process as a six-inch twig does to a tree.

Men with petrified thoughts cannot get down to the root of what they are doing every day. A technical analysis of the processes, however, starts without any assumption of the traditional value of each step, and makes not only each step prove its necessity, but makes the whole process show why it cannot be replaced by something much quicker, and much cheaper, or much simpler. Of course, most processes have their reason for existence, because they were developed in response to necessity during all the past years.

Why a Technical Man Should Be Chosen as Investigator

But a few processes are sure to be found that have been overlooked or neglected by more modern possibilities or short cuts. The discovery of only one or two of these processes gives a magnificent return for the study. Who should make such studies? Evidently technical men who have the scientific habit of mind which takes nothing for granted.

A technical man who knew nothing at all about the processes would, almost surely, be more valuable as an investigator than the man a foreman would pick out. The shop man believes that an investigator should know all the kinks of the trade or else he cannot possibly be of any use.

However, there is no need to go to either of these extremes; for men can be found, or quickly trained, who have the scientific point of view and are acquainted with the primary conditions of the industry.

Suppose a good process is discovered in theory. In putting it into practice the technical man undoubtedly first bumps up against the iron-headed foremen or workmen. A thing which is new is unsafe and, in the opinion of the shop man, is sure to fail 99 times out of 100; so, he argues, it is much better to go on with the method that you know will work. The workman also knows just what his present working conditions are, and how they affect his pay envelope, and his presence in the company. He is not always sure what will happen if some change is made. Needless to say, a foreman who has such a fear is not a very valuable foreman, at least in his present state, for if he was really valuable as an executive he would be conscious of that executive ability and know that the company could use him in any new situation. But foremen are not all high-class executives by any means, nor have they an executive point of view. In fact, the depart-

TESTING WITHOUT HIGH FACTORY EXPENSE

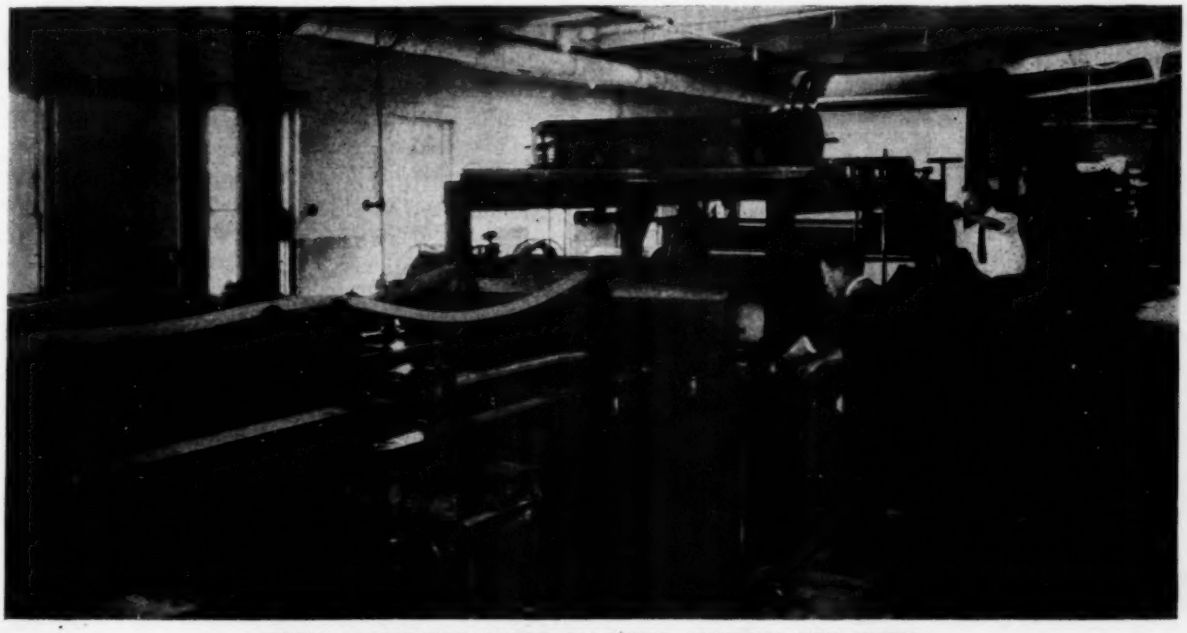
If the formula passes the test-tube stage successfully it is tried out on this model paper-making machine and a strip of paper 4½ inches wide is made. Operating conditions are approximated at lower costs for materials, and for equipment charges

ment of technical control does a good deal to educate them as executives.

Suppose a process were found to be admirable in theory, and wholesale instruction were issued to the entire plant to adopt the process immediately. This would mean that the unfortunate process would be brought up against all the iron-headed men at once. Their opposition would be crystallized and united and would probably kill the desirable improvement, and this is as it should be. This refusal to overturn the whole plant is a kind of insurance tending to prevent radical changes and substitute rather an orderly evolution that is far more lasting in its effect. Moreover, we find, of course, that ideas which are excellent in a laboratory sometimes do not work at all on a manufacturing scale, and such ideas always have to be adapted more or less in applying them to various mill conditions. Therefore, the planning of a new method, the introduction of it, the cutting of iron-bound methods, the winning over of the human force to co-operation, are all done together. This means that each idea must start from a small beginning, prove itself step by step, and spread gradually through the plant, conquering the methods and the men as it advances.

We first started, not with all the new ideas that we had, but with one or two of them. On each new improvement we first selected one corner of some one mill where the particular process we were aiming at was being done. The selection of this corner in the mill was determined by the character of the foreman or gang boss. We wanted to select the kind of foreman who was either of extra intelligence or free from any suspicion of losing his job. Perhaps we could even be fortunate enough to get a man who could look forward to being the first to inaugurate a new and valuable process.

In some cases we selected a good-natured kind of foreman who laughingly does not care what you do to his department, provided that he is insured against being held responsible for the funny things that you are going to do in front of his nose while he has an orchestra seat at the entertainment. Such a man will laugh at you when any detail goes wrong, but more often he will pitch in and help to correct the detail. If you can once get a foreman or workman helping you to iron out kinks he has sold the new process to himself and will work might and main for its practical success. If it does succeed he has sold to himself the scientific point of view on all other questions. In this way he becomes a missionary. That is why the personality of the foremen is as important a determining point as the economical layout in selecting the corner from which to try out the new idea.



THEN A LIFE-SIZE PAPER MACHINE FINISHES THE TESTS

The laboratory has its own mill building, including a big machine with adjustable parts to make it the equivalent of many different machines. But these three steps are only the beginning. The idea, thus tested and improved, is transplanted to a corner of one mill and spreads from there to the rest of the mills

When the new process, in its first corner, proves its success to us and to the first foreman by an improvement in the character of the product or a lessening of costs or better working conditions, we get the results reduced to actual figures of some sort, together with actual samples of product or partial product. Then we go to another unit, a small corner in another mill, for instance, selecting where possible a foreman who either particularly needs the solution or who is sensible enough so that it is easy to show him on paper the proofs from the other installation, and get his co-operation in installing it in his unit.

Every successful installation makes it more easy to spread the new process.

What Determines When a New Process or Method Is Established

Perhaps we have to sell it several times; or perhaps the news of it has spread among the superintendents and foremen. In some cases our problem soon is not so much to sell the process to additional foremen as to arrange a schedule for responding to the requests that swamp us for introducing the improvement in their departments.

When such a condition exists we may then say that the new process or method is established.

The same is true of the whole technical department after one or two of its methods have been successfully established. Finally, the reputation of the technical department is made in the organization and foremen come asking for its advice or its investigations on subjects that the department has not yet thought of or had time to undertake. The technical department has now found itself. To be truly effective, the technical department must have the co-operation of the workmen and the other departments and must permeate the whole organization with its technical spirit toward processes, working conditions and product.

The wise head of a new technical department looks forward to this desired consummation while he is laying the corner stone to his department. He is not only content to start small, he wants to start small, spreading by and with the consent and demand of the rest of the organization.

As the department increased in service and experience, we were able to standardize more or less our methods of introducing improved processes. Much of the preliminary investigation can now be done in the laboratory. The test of processes is in the product—in its quality, its accuracy to specification and its use of working.

The Department of Technical Control of the American Writing Paper Company now has a complete paper mill to itself, with all the equipment necessary to enable it to carry through its work on both a small scale as well as a full-sized manufacturing scale. All experimental work first begins on a small scale called the test-tube size. At the second stage a sheet of paper used to be made by hand, on a small hand mold, just as all paper was made 150 years ago. The pulp for this hand sheet was prepared in a small motor-driven beater. There has just been added to the equipment of the department a small model fourdrinier paper machine which works more nearly like the large paper machines. This model machine is complete with fourdrinier wire, two pressers, dryers, calender and reel. It produces a strip of paper 4½ inches wide instead of the 60 or 70 inches of the mill paper.

If the first small experimental run appears satisfactory a batch of 250 pounds is then made. For this work there is a beater of 250 pounds' capacity that is in reality a regular mill unit of 750 pounds, but rebuilt to reduce the volume handled. The paper in this way is run off on a full-sized paper machine especially constructed to handle small amounts when necessary. If the product still appears satisfactory in the main, but shows certain flaws, the process is adjusted until these flaws disappear. Sometimes it is necessary to run a number of successive batches of 250 pounds each before the desired results are obtained. If this number of batches were to be run in a regular paper mill the costs, material and time used in manufacturing this number of batches and either throwing them away or selling them at low prices would be entirely prohibitive. It would also be impossible to exercise the same degree of technical control over the regular mill equipment. It is usually possible to complete all necessary data at this 250-pound unit scale.

The next step is to make a small commercial run, using the paper machine in the Department of Technical Control at its full charge capacity. The product from this machine is a commercial proposition and is handled accordingly. In transferring the laboratory data to any of the regular mills it is possible to assist the superintendent not only with complete data but also by supplying a complete operating crew to assist him in producing paper like the lots made at the Department of Technical Control. Then, too, we have him bring over his workmen to the laboratory mill if he wishes and we explain to them the reasons for any small variations from the usual methods.

Many of the improvements and processes thus developed can then be applied to the other mills. In some cases these problems are worked out for only one mill, or even one machine. Still it is worth while to put the proposed improvement through all the four steps.

The paper machine of the Department of Technical Control has been specially equipped, so that it may be shifted over for the making of practically any kind of paper. Many people think that paper is quite simple and that there is, after all, only one kind. As a matter of fact, the variety in the kinds of paper made by the American Writing Paper Company alone is very great and includes all but a few of the coarse low-grade papers. The opportunity for cutting corners and fitting processes more exactly to each particular kind of paper is therefore very large. This, of course, is true of the products of almost any manufacturing company.

The value of getting right down to the ground and making a new study of all processes is evident soon after the technical department starts work in its industry. We, for instance, proved our value very quickly. One experiment in sizing alone saved the company a quarter of a million dollars. A very expensive contract was about to be entered into with a

patented sizing process, but just before the contract was closed the specifications and samples were turned over to the new technical department for a last-minute examination. As a result of a scientific study of the principles of sizing it was discovered that a better sizing could be made. Therefore, not only was the contract rejected, but sizing was made cheaper and better than ever before.

Investigations of all technical questions are on a makes the complaint is not able to tell him the cause. He spends a day, a week or, if necessary, a month, right at the mill watching th eactual operation, until he either diagnoses the cause of the trouble or else lays out a plan of attack that will result budget system. Several members of the staff are assigned technical problems or mill investigations commonly called trouble jobs. The man assigned to one trouble job may not know what it is or anything about it. Perhaps the superintendent who in a final solution.

HOW PAPER IS SPECIFIED EXACTLY

There is no guessing about whether one paper is exactly like another. With these instruments the physical characteristics of each paper can be measured and any paper exactly reproduced. Large customers save money by making their own tests

Usually we find it more convenient to have a man spend a few days at the mill first and then come back at intervals of a week or so and spend another half a day or a day each time, rather than put in a steady month at the plant. For, in the interval, his conscious mind is doing something else, but his subconscious mind is working on the problem and when he returns he has again a new view of it and perhaps the solution comes to him like a picture being flashed on the moving picture screen.

Each man may have several problems on his program at any one time. He keeps a separate folder on each one and drops it in a wire basket on his desk when he is not working on it. The chief of the department stops occasionally to examine the contents of the folder and see how the problem is coming on. Perhaps he may be able to suggest a solution or method of procedure.

No one man on the staff is allowed to have so many assignments that he cannot go through each one on a schedule. The plan is to go into a problem, clean it up, pass the solution over to the manufacturing department and be ready for another problem. If this can be done in two days so much the better.

It is quite as important for the factory scientist to continually practice the scientific-mind habit as it is for the factory workmen. In other words, he must not hesitate to undertake an investigation for fear that it will be unprofitable. For many of the most profitable investigations were first inspired by nothing but pure curiosity or scientific interest. Therefore, our chemists are free to investigate independent questions, even though these questions seem to have no possible immediate application. The only requirement is that the solution of the problem must add to our fundamental knowledge of the subject. Some of the department's investigational work has even carried the problem into the plants of competitors, in cases where the competitors have requested the assistance of our laboratory.

Through the request of various branches and departments it has been possible to draw up a definite schedule of work under way which has for its purpose a study of standard practices. As fast as a process is investigated it is reduced to writing and a standard practice agreed upon recording each step scientifically with the quantities of material put in, the time of runs, the costs, and so on.

The practical man has always thought that the paper business was too large a business to reduce to anything so definite as writing. A paper machine is supposed to be almost human in its psychology, like a prima donna, and so it is to be treated differently at every minute by the diplomat who has it in charge. But we have found the ways of machinery, as well as most of the essential elements in a paper machine and its action. Of course, it is true that no two paper machines are alike, for a paper machine costs from $50,000 to $500,000, and building one is like putting up a factory. Yet the elements in their principal arrangement are enough alike to be measured for comparison.

After recording and standardizing the manufacturing equipment, processes and product, it will then be possible in many cases to direct different mills to make a given amount of paper to a definite specification and at a quoted price. This is, perhaps, looking somewhat ahead into the future, and all the difficulties involved are fully appreciated. Yesterday such an idea would have been considered impossible; today it is recognized as a possibility, while tomorrow it will be an accomplished fact.

When the modern plant operates ideally each individual in the plant will continuously record data

and information for transmission to the main center, where it will be correlated with information from other individuals, and either filed for future reference or issued as a new general order to the whole or part of the plant. The most successfully operated plant possesses complete information on its operating conditions, the result of careful analyses of the data correctly transmitted from the individual and properly recorded by the main office.

When such a condition is reached it is then able to improve existing processes, one by one, because it not only has all the facts of that process properly correlated, but in addition it is able to carry on such a study as will enable it to pass judgment with complete information at hand. The existence of such a central technical department helps to awaken the scientific spirit in the workman, adds to his own knowledge, and probably most important of all, it causes an exchange of knowledge between all. The experience of each is available to all. This company knowledge becomes the starting line for further progress and effort.

Importance of Costs and Their Relation to Manufacturing and Banking

By ELLERY A. BAKER

Assistant Vice-President, The National City Bank of New York

Address Before the Cost Association of the Paper Industry on April 13, 1921, at the Waldorf-Astoria Hotel, New York

COSTS are of mutual interest to both the business man and the banker; both today are giving much more thought and attention to the subject than ever before.

There has been so much said and written in the last few years that it is not necessary for me to explain what is meant by the term "Costs." Every manufacturer in this room has some cost method in operation in his factory, and yet I fear that these methods lack uniformity, and that if I were to visit the different plants owned by the members of this association, I would find a great diversity in the methods employed, even in the fundamentals. No doubt you would say to me that there must be a great diversity in methods of figuring costs owing to the varying conditions, different locations, various kinds of products, etc. All this I grant you, yet the underlying principles of costs are the same whether they be applied in an iron foundry, a textile plant or a paper mill. The difference comes in the working out of the details and in the refinement.

Simplicity an Essential

Today practically every line of industry is endeavoring to adopt some uniform plan whereby all of the different members can figure their costs along the same line. There have been many attempts made that have been failures. The reason for this is because the plans have been too complicated.

I realize that very often when one talks of "Efficiency" or "Cost Finding Methods" to the manufacturer he immediately has a mental picture of volumes of detail, confusion in his shop and chaos in the entire organization. This very thing has happened many, many times—it is a condition which has been brought about by men posing as cost experts who really did not know their business, but the practical high grade industrial engineer can be of great assistance to the manufacturer. Many so-called "Cost Experts" in their eagerness to make a showing have involved the company for which they were working in an almost endless amount of detail and red tape.

I have seen cost systems which in their operation reminds me of a ride on the "merry-go-round." You mount a hobbyhorse; there is a period of dizzy exhilaration, figures flip by in bewildering profusion, the music stops and you alight exactly where you began—you have not advanced a foot, a day, nor an idea.

In order that any uniform system may be of value to an industry, it must be clerically simple. One of the greatest difficulties that confront the installing of cost systems in this country is the undue clerical work and red tape involved. I believe that costs should be apportioned from a practical factory standpoint and any uniform system to be adopted by an association must be practical and based upon common sense ideas. It is impossible to expect the same refinement in one plant as in another; uniform principles apply to all plants; the refinement must be individual.

All manufacturing costs are made up of three main elements, namely, material, labor and manufacturing expense. Then after the manufacturing cost of any article is arrived at, there is still another expense that has to be taken care of, namely, the selling or commercial expense. That is the expense incurred in placing and keeping the finished product on the market. The difference between the total cost on the market and the selling price is the net profit or loss made by the manufacturer.

This all sounds very simple, and if it were all there is to cost finding methods, arriving at and maintaining up-to-date costs would indeed be a simple process.

To be of the greatest value to the manufacturer, any system should perform two main functions, one

to give the cost of the finished article as a basis for fixing the selling price, and the other (and perhaps the more important) to give the cost of the production by operation throughout the factory. Then in the event of the costs being excessive the system would show exactly where the weakness lies, thereby affording a means of control. Records are only valuable from a control point of view, and when they record what is going on today. Today's increases over yesterday's and this week's increases over last week's can be intelligently spotted and the remedy applied, but what took place last year is too far away for drawing definite conclusions. Yearly percentages are chiefly of value in order to check up and confirm the general trend of results.

To get results, cost records must tell their story without distracting detail; brevity, precision and logical order are essential. Masses of detail which compel an executive to spend hours in analyzing before he can reach a final conclusion are expensive, tiresome and fail to attract attention.

From years of experience in going into all kinds of factories, in all lines of industry, with an idea of introducing methods which would increase the net profit of the company, I realize that it is impossible to have any standard method which can be applied to all businesses alike. Every business, as a matter of fact, presents certain unique and peculiar conditions which must be studied individually.

Methods That Affect Production and Sales

Increases in net profits and improved conditions can be brought about in many different ways, depending upon the condition of the business. In order to do this there should be:

Practical methods of purchasing, receiving, storing and issuing of materials and supplies.

Methods of keeping track of men and machines.

Methods of knowing the exact costs of waste occasioned by the different kinds of manufacture and reducing the same to the minimum.

Methods of wage payment, introducing piece work, bonuses or other stimulating wage plans, wherever practical.

Methods of determining the cost of different articles manufactured, with a view to knowing whether or not adequate profits are being secured on each class.

Methods of keeping track of the cost of operation of different departments as regards material, labor and expense; this done in such a way as to give the management the best possible control over the various details of the business.

Methods of handling customers' orders, regulating production, routing the product and keeping track of the progress of the work throughout the factory.

Methods in detail of handling the office work in such a manner as to provide, if desired, monthly or periodical statements of assets and liabilities showing the profit or loss according to the classes of goods handled; this done in a clerically economical way.

All of these methods have a direct bearing upon production and the cost of the finished article. Practically every manufacturer has records and reports covering each one of the points mentioned, but very often these reports are not brought together in such a way as to be of real value to the executive in charge.

The purchasing, receiving, storing and issuing of materials and supplies has a direct bearing upon the cost of production. Oft'times as the product is going through the factory, the superintendent or foreman awakens to the fact that he is short of some certain material which holds up the entire production of a particular product for a considerable length of time. This, of course, could be avoided by proper stock records. Such records might cost the management a little extra, but they are bound to save the cost of operation many, many times. A well balanced inventory is one of the most valuable assets that any company can maintain; any simple, common sense system whereby the Purchasing Department may be notified at the proper time as to the condition of low stocks is of the greatest value.

I believe that the average manufacturer of today is not paying sufficient attention to this phase of his business. Generally speaking, there is considerable attention given to methods of keeping track of men and machines. Almost every manufacturer realizes the importance of this and governs himself accordingly.

Waste and Its Bearing on Costs

Waste is another factor in the manufacture of paper, as well as in other lines, which is not watched as carefully as it should be; it is the one thing that increases the material cost of the finished product from the raw finish going to the machine. Waste might well be classed under two heads, "Natural" and "Unnatural," or, perhaps more properly speaking, "Avoidable" and "Unavoidable," the first in each case being the waste which must necessarily be made in the finishing of the paper, and the second being that occasioned by carelessness, in the way of defective product.

Some practical, common sense method of following this waste should be adopted by every plant, so that the loss thereby can be reported viewed from time to time and included in the final cost of the finished product.

Labor

During the past few years, owing to labor unrest, it has been very difficult to make changes in methods of wage payment. Any of you manufacturers who have kept records showing your man-hour efficiency on your different lines of product, know full well that during the first six months of the year 1920 you were getting less production per man or machine hour, than you had been for a number of years. Not only

had the wages of the employes increased very materially, but the production had fallen off decidedly. If that record has been kept up, I believe you will find that this condition has entirely changed and that you are now receiving a decided increase in the way of production per employe. It is easier today to make changes in wage payment than it has been at any time during the last four or five years.

Although labor always looks with suspicion on any piece-work or labor incentive plan, yet it is true that there is no fairer way in the world to pay the employe than on a straight piece-work basis, providing manufacturing conditions are such that this can be done, and that the piece-work price should be fair to both the manufacturer and the employe.

A great many plans are being made and much effort put forth at the present time in the study of the labor situation and increase of production. The best plan, I believe, is for each manufacturer to study his own proposition from a practical, common sense standpoint, realizing that he must deal differently with labor than he would with machines, for he has the human element with which to contend.

Manufacturing Expense

In building up any cost system, one of the most difficult elements to properly allocate is manufacturing expense. This expense is made up of a great many different factors. In the average plant, the proper method is to build up departmental showings. There are fixed charges and general overhead expenses which must be divided and subdivided and then placed against the productive departments; the plans should be so worked out as to finally place all expenses against the production departments. If this is done then it is not difficult to arrive at departmental cost figures which can be applied to the product in such a manner as to produce a commercially correct cost.

Average Figures Are Dangerous

I realize that monthly figures are of very little value so far as being of assistance in arriving at a selling price; their real value is for control purposes. Costs to be used as a basis for fixing a selling price should be fixed over a period of time. Just what that period of time should be depends upon the conditions surrounding the individual plant in the industry. In different businesses that period would be different, but the period should always be the immediately preceding one.

I find that a great many manufacturers are prone to consider the average figures taken over the preceding year. Six or seven years ago, when conditions were different, this practice would not have been very misleading, but today, due to constantly changing conditions in all elements of cost, there is grave danger of arriving at a cost which is misleading and worse than no cost at all.

You may feel that I am laying too much stress on costs and that I feel that costs are the only thing that will give results in any manufacturing business. I do not believe that at all. No matter how good a system is installed, unless it is used and kept up to date, it will never save the management a penny. In fact, the cost of gathering the figures is, to that extent, a loss. The only value of such a system to a company is the moral effect it has on the employes, and if the figures are not used, it is not long before the employes know that records are not depended upon and they become lax and all benefit is lost.

I would not belittle the effort of any individual, for after all the success or failure of operating any business depends also upon individual effort. I would much rather have an able, practical man in charge of a factory, without any cost system, than to have a weak, incapable man in charge, with the best system in the country; but surely the able man with a good system is in a position to accomplish the very best results.

Some manufacturers in arriving at the cost of their product figure the individual costs on a more or less average basis. That, too, is a dangerous policy to pursue. It is quite possible that the average cost, from a bookkeeping standpoint, may forecast the true situation so far as total profit or loss is concerned, yet it is equally true that there may be certain lines on which the manufacturer is making a large profit, and other lines little or no profit, many times a decided loss. With such a method it would be impossible for him to know anything further than his total profit or loss.

As an illustration, some time ago I visited a foundry where the product varied from castings weighing less than a pound to castings weighing several tons. Let us assume that a moulder's wage was $7.50 per day; a man working on small castings would do well to produce 250 lbs. of castings per day, whereas the man working on larger castings could easily produce on an average of 1,500 lbs. per day. Both men were paid exactly alike, and for $15 the manufacturer received 1,750 lbs. of castings at an average cost of 85c per hundred pounds. This average cost, from a bookkeeping standpoint, would tell the true story and give a true profit or loss, but I think that the really important fact is this: That the light casting was costing 3c per pound and the heavy casting ½c a pound, and that the manufacturer was using 1c a pound as an average. He was certainly making a big mistake, for it meant that he was charging altogether too much for the heavy castings and too little for the light. If he continued this practice, it would not be very long before he would lose his business on the heavy work, which was making a very satisfactory profit, and the shop would be filled up with the light work on which he was suffering a decided loss.

I know that conditions of a like nature have existed in the paper industry, that paper manufacturers have

been misled, and I believe it is possible that they are today being misled by arriving at the cost of different grades of paper on an average basis.

Why Prices and Profits Were Often Inadequate

Conditions have been abnormal during the last few years, and up to a few months ago adequate prices had been obtainable for practically everything manufactured. Today this is not true, nor is it always true in normal times. A careful study of the census figures as prepared for the period before the war shows that very few lines of activity netted more than 6 per cent on capital invested. I do not believe that any manufacturer is content to carry on his business with less than the current rate of profit, if he knows what he is doing, but many do not know until it is too late.

The truth of the matter is that in times like these, and also in normal times, there are few adequate prices made. The reason for this is twofold: First, it is a lack of knowledge of what the goods are actually costing, and second, the fear that each individual manufacturer has of his competitor.

What the Association Can Accomplish

The most constructive work that your association can do is to undertake to correct and remove these two great causes of inadequate prices. Reduced cost can be secured through greater production, better technical methods of control, and through better relations with labor.

All these things can be and are being accomplished through association work, by working together on cost problems and developing a uniform basis for figuring the cost of production.

Fear in industry, as in every other phase of life, is the result of ignorance. In most industries the manufacturer is compelled to rely for his knowledge of selling price on information which comes to him through his customers and his salesmen, but it is unfortunately true that both the customer and the salesmen exercise a debasing influence on prices; the customer, because it is to his advantage to do so; the salesman, because of a mistaken feeling that his best interests are tied up with his customers and not with the house for which he is working. The latter always believes that there is some error in the cost and that the price given him is high. Another aspect of fear is the panic-stricken feeling which comes over the manufacturer when he sees his volume of business dropping off; he immediately thinks that his competitor is getting more than his share of business and that it is necessary, in order for him to maintain his volume, to reduce prices. If a manufacturer has the right kind of a cost system, the expediency of taking an order in keen competition at a close price becomes purely a matter of policy. Without a correct knowledge of cost the expediency of booking an order at a close price is bound to be a guess, and after delivery is made and settlement secured, the profit realized is still a guess, with the possibility that a loss has been incurred instead of a profit made.

No sales organization, no matter how well organized, can work to its greatest efficiency under those conditions.

Every Plant Can Have a Cost System at Small Cost

From experience I know that every manufacturer feels that his own proposition is the most difficult one on which to figure costs. He does not understand how costs can be brought out on a multiplicity of different lines and grades without incurring a large amount of clerical labor and expense and causing more or less chaos in the factory. Many times in the past fifteen years in talking to manufacturers I have been told, "Oh, yes, Mr. Baker, I am a firm believer in costs, but my business is a peculiar one. It would be impossible for me to figure costs on my different lines of product. I believe in costs and that a good cost plan is just the thing for the average manufacturer. I can see how such and such a man would be benefited and could arrive at dependable costs, but from long years of experience I know that I cannot introduce cost methods in my factory. It would mean too much detail, too much clerical help; it would hinder production; my superintendent could not get out the production; it would cost me a lot of money and do a lot of things I could not think of tolerating." I have even heard paper manufacturers talk in this way. They seem to reason along the same lines as other manufacturers. This belief, however, is a mistake. No one realized better than I do that it is much more difficult to figure costs in some plants than in others, yet I know that it is possible to install in every plant, large or small, and in every line of industry a satisfactory system which will give commercially correct costs and enable the management to operate its business intelligently without incurring a heavy expense for maintenance.

Letting the Other Fellow Make Your Prices

Not long ago I met a manufacturer who told me he was not very much interested in any cost system. He said he had been in business for many years and that he could estimate his costs very accurately. "I have to meet the other fellow's prices in order to make sales. I know that I can produce as cheaply as the other man; for that reason, I know that I can sell as cheaply as the other man, so why should I worry about my costs? I have made money in the past and I can continue to do so in the future."

This man, however, forgets that possibly the man with whom he is competing does not know any more about his costs than he does, and the chances are that both are selling at a loss. He is in a dangerous condition, and he is the type of man who is causing

trouble in all lines of industry. In your line of industry or in any other, it is not the man who knows his costs who is feared in competition; it is the manufacturer who is guessing at his costs or letting competition fix his selling price who is causing chaos in the market. He undoubtedly will be bankrupt before very long, but during the existence of his company he is much to be feared.

Cost Finding a Continuous Process

Undoubtedly by this time the thought that is in the majority of your minds is that the system I have outlined sounds very formidable. You must bear in mind that the figures are gathered month by month as we go along. The fund of information is not collected at one time. It is a continuous process from day to day. I find that the large majority of manufacturers are employing clerical help enough to not only give them common-sense, commercially correct costs on their product, but also to enable them to bring out monthly profit and loss statements showing just where they are standing at the end of each month.

The Banker's Interest in Costs

The banker is vitally interested in having the manufacturer maintain a practical cost system. He realizes that the measure of his success depends very largely upon the success of the manufacturer. It is impossible for the manufacturer to obtain the greatest amount of success unless he operates his plant efficiently and does know the cost of the different lines he is manufacturing. It is almost as though the manufacturer and the banker were going into partnership, the banker assisting in furnishing the capital, the manufacturer operating the plant. If the banker furnishes the capital, he is surely interested in knowing that his capital is handled efficiently, and the manufacturer today who does know his costs is in a position to cooperate more thoroughly with his banker than the man who does not attach sufficient importance to the plan of his business. There is no question that the former will be granted more favorable consideration by the banker than the latter.

To a certain extent, the banker must be governed by the ratio of quick assets to current liabilities. He realizes the necessity of having a sufficient amount of working capital in order to operate the business successfully. Oft'times in the past the manufacturer has failed to realize the necessity of these requirements. He has laid particular stress on his fixed assets, his working conditions, forgetting that even though his plant is in A-1 condition, his machinery well placed, his organization better than the average, his product desirable, yet with all of these, unless his company has sufficient working capital, it is impossible to continue in business and make a profit.

Many a prosperous concern has been wrecked and forced into bankruptcy, not because the business has been undesirable, but because a proportionately excessive amount has been tied up in brick and mortar and fixed assets, not leaving a sufficient amount of working capital.

One of the big troubles today is that practically all of the manufacturers have large inventories of raw materials, goods in process and finished stock. During the early part of the year 1920 the banker advised the manufacturer very strongly to reduce inventories wherever possible. As a general rule his advice was unheeded because the manufacturer believed he was making money by carrying large inventories, so later in the year when business fell off, large inventories and large commitments were almost universal. The manufacturer has been forced to take large shrinkage in value. He now realizes his mistake and is steadily working down his inventories to what should be a normal, healthy basis.

Inventories of raw material, goods in process and finished stock are generally included in quick assets. The banker is generally told that all goods in finished stock have been inventoried at manufacturing cost price. I do not believe that the manufacturer without a cost system is in a position to arrive at definite values on either goods in process or finished stock. There is always a great variation in the minds of manufacturers as to just what their manufacturing costs comprise. I presume, should I ask a dozen different manufacturers in this room today just what they considered as manufacturing cost, there would be nearly that many different methods of arriving at it, so after all, the banker who is accepting large inventories of goods in process and finished stock as a quick asset is taking what may be of questionable asset value. If your industry had a basic, uniform method of arriving at costs, so far as it is concerned, you would have gone a long way towards establishing a better relation between yourselves and the banks with whom you are doing business.

Banking and industry are so closely related that it may be said that it is impossible for one to exist without the other. Judging from the past it would appear that there had never been a thorough understanding between the two. It almost appears sometimes as though the banker and the manufacturer have been speaking in different languages. Never in the history of our country has there been a greater need of cooperation than today, and I believe the manufacturer and the banker are cooperating more closely now than ever before.

Throughout the period of the war and up to six or eight months ago, the manufacturers of this country had been producing in unparalleled quantities. Now, owing to the unsettled conditions prevailing in almost every corner of the world, our manufacturers are unable to produce anywhere near the capacity of their plants. They have been forced to make readjustments all along the line. The problem for many

a manufacturer now, I believe, is to work out a plan whereby he can operate his plant successfully on a reduced volume of business.

Success is ofttimes the cause of failure. Sometimes manufacturers have been successful in the past and were not satisfied to continue to gradually increase their business. They have felt sure that they could branch out and become one of the larger businesses of today. This has often spelled ruin for that company. Both from a manufacturing and banking standpoint, it is better to be a medium sized, successful concern than to be one of the larger companies continually struggling for its very existence.

In order that the banker may be of the greatest possible service to the manufacturer, he must understand the needs of the manufacturer. If the manufacturer is to help the banker and the banker to help the manufacturer in turn, there must be no closed books; there should exist a perfect understanding, a perfect confidence, a human relation between both parties, for without this the ideal of mutual assistance can never be attained.

Ofttimes in the past I have known instances where the industrialist has considered it would be well not to divulge certain information in regard to his business, fearing that it might have an adverse effect on the banker's opinion as to his credit standing. In my work as an industrial engineer, I have seen this thing happen many, many times. I know that such a proceeding is a mistake, for later this unrevealed condition is sure to come up, and right there begins the lack of confidence in the banker's mind.

The true functions of banks require them to be leaders of business progress. The bank can and should be of infinitely more service to the business man than simply a place to take care of deposits and grant loans. If this were the banks' one and only object, there would be very little progress made in banking. The industrialist, I believe, is looking to the banks more and more each day for help and advice, and after all, who is in a better position to give dependable advice than the banker?

I do not expect that you will agree with all that I have said, but if you take away with you the following points for consideration I shall be well satisfied.

That every manufacturer needs common-sense, differential costs on the different lines of product he is manufacturing, and that there never was a time when he needed them more than now.

That any industry such as your own needs a basic, uniform cost system which can be applied to the industry as a whole; then when you meet together and discuss certain elements of costs, included in those elements will be the same items.

That costs in order to be of value must deal with current expenditures and prove with the books.

That the averaging of costs on different lines or styles of product is a misleading and dangerous policy to pursue.

That percentages used in arriving at cost figures must not be taken over some far-away period; the period should always be the immediately preceding one, and in times like these even that view on a common-sense basis.

That practical cost figures can be obtained in your line of industry without masses of detail and red tape and, generally speaking I believe, without very much increase in the clerical force.

That inventories of raw material and finished stock should be worked down to a low basis even though losses have to be sustained by so doing, and that the manufacturer, instead of figuring out how large a business he can do, should give thought and attention to the volume that his company can safely handle, still keeping within its limits of working capital.

That the man who has such a cost system in operation as to give him practical costs and control of manufacture is in the very best position to cooperate with his banker, inasmuch as the figures presented to the banker are bound to create confidence, because they give a true picture of the situation.

I believe that all these points are worthy of your consideration; that they all have a direct bearing on the successful operation of any business and the relation of the manufacturer to the banker.

Do not ruin your life by careless habits, says the National Safety Council.

Thanks

My teeth are aching badly,
  My ears are aching, too;
I've got the rheumatism—did
  It ever tackle you?
My head is nearly bursting—
  I live in Misery Flat:
But for every pain I haven't got
  I'm much obliged, at that!
I owe the tailor something,
  The gas bill isn't paid,
And now my grocer'll have to wait,
  I'm very much afraid!
I've overdrawn my bank account—
  I'm in an awful stew;
But I am very thankful for
  The bills that aren't due!
Calamity has hit me
  In every place it could;
I haven't an experience
  That's really any good.
And yet when all is stated
  In language short and terse,
I'm really very grateful that
  It isn't any worse.

—Henry Edward Warner, in Richmond Times-Dispatch.

Power Plant Management

Bonus System for Boiler Room Employes

By ROBERT JUNE, M. E.

THE writer is fortunate in numbering among his friends and acquaintances the chief engineers of a dozen or more of the largest power plants in America. Recently he addressed a general letter to these men asking for a brief description of the bonus systems, if any, used by them as a basis for reward of boiler room employes. To his surprise these letters were not especially productive of results —most of the replies containing requests for information instead of furnishing it. One answer is typical of the present situation with the majority of large power plants:

"We try to educate our boiler room men to the fact that power must be produced economically and that this means that high operating efficiency must be maintained. We instruct our men carefully in their individual and collective duties, pay them high wages, and generally give them to understand that we regard them as skilled operatives from whom we have a right to expect high-grade results. As an incentive to good work we post each Monday on the bulletin board in the boiler room the daily record of over-all boiler efficiency for the preceding week.

"While our results in the main are good, we want to improve them. For one thing, we are going to try to separate the percentage of our 24-hour load handled by each of the three shifts. We are doing this on the principle that if one shift handles 50 per cent of the load, and another 30 per cent, and the third 20 per cent, that we should get correspondingly better results from the shifts handling the largest loads. After we have established the proper efficiency for each shift we are going to put in a bonus system of some sort. We are already working on this but, as you realize, there are a good many angles to the problem and we should be glad to have any information which you may possess."

This, then, is the situation in many large plants. They are paying high wages and trying to educate their men, in some cases by weekly conferences in conjunction with occasional informal lectures on various phases of power plant operation. Close supervision of the work of the individual and personal leadership, evoking a high esprit de corp, are the principal reliance at present. It is considered, however, that these are not enough and that a properly devised bonus system probably offers the necessary supplementary incentive.

Turning now to the smaller power plants, we find that they have been readier to adopt bonus systems. Presumably this is due to the fact that they find it more difficult to provide educational facilities for their men and to exercise close supervision over their work. While the systems used are not elaborate, they seem to be effective. The point here worth noting is that the tendency in both large and small plants is increasingly toward the use of the bonus systems.

Principles Upon Which Bonus Systems Should Be Based Above Line

The term "bonus" may be taken as meaning additional compensation, above a fixed amount, based on net savings effected above a certain minimum, through the personal efforts of the recipient. It means that if the operator can reduce the cost per unit of the product he should receive a portion of the savings. As applied to the boiler room, a reasonable efficiency, based not alone on the results previously obtained in other power plants of approximately the same size and general characteristics, must be determined upon a base line or starting point.

Before blindly assigning an arbitrary value to performance above this line we ought to ascertain with some exactitude the relation of the power plant expenses to manufacturing operations as a whole.

Our reason for this is that it will practically always be found that power plant expenses for any business, whether central station, paper, brick and clay, textile, refrigeration, etc., so far as the individual plant is concerned, vary along the line of a fixed curve, depending upon the output of the plant. That is, if the factory as a whole is operated at 100 per cent capacity, power costs will bear a definite relation to the product in terms of pounds, bushels, yards, tons or whatever unit the product is measured by. Let us say that our power cost is 10 cents, or $1.00 or $10.00 per unit, at 100 per cent factory output. If we reduce factory output to 80 per cent we will find that we have a different power cost per unit—say 12 cents, or $1.20, or $12.00—and if we reduce factory output still further, say to 50 per cent capacity, we will find our cost per unit further increased to, say 15 cents, or $1.50, or $15.00.

Variable and Non-Variable Expenses

The determination of this curve is not a simple matter. It cannot be done in a week or a month, but it is well worth the effort, even if it takes a round dozen months. The first step is a complete appraisal of the power plant, which should include the value of the land and buildings occupied, the complete steam generating equipment with all accessories, the

turbines, engines, feed water heaters, condensers, pumps, generators, switchboards, fire pumps, sprinkler sytems, all piping and all wiring which apply wholly to the power plant proper, as well as all main lines of pipe and wire on which steam, water and energy are carried to the factory centers.

With our appraisal on hand we at once discover that the reason our power-cost-per-unit is a curve is because power plant costs fall into two divisions—those which do not vary with the volume of product and those which do vary with factory production. As an illustration of non-variable costs, we have interest, depreciation, taxes and insurance. To these must be added, if the power plant is to serve the factory with any amount of power up to 100 per cent, cost of labor, fuel required to bank fires and to keep prime movers turning over but doing no useful work, and the lubricants, water, ash removal required for the purpose, heat and light for the power plant, etc. These items vary but little regardless of the factory output—whether it be 30 per cent or 100 per cent capacity.

The variable costs are, of course, coal, feed water, lubricants, ash removal, some equipment maintenance, and a certain amount of general supplies, such as waste, packing, gaskets, etc.

Figure I is a typical graph, illustrating the relation of the variable and non-variable cost factors to the column of production. Figure II is the curve (in this case assumed) resulting from the combination of the variable and non-variable costs. Armed with this curve the manager is ready to talk business to his chief engineer.

First, be it noted that, in using the curve, the manager does not have to be concerned about a single

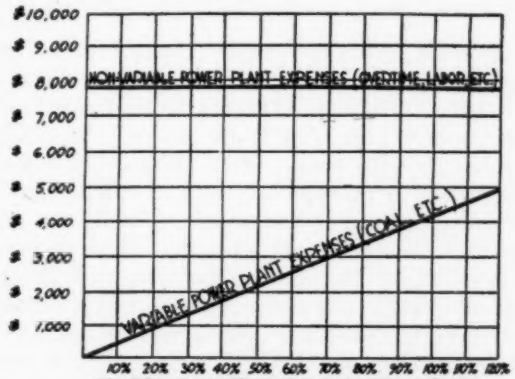


FIG.1-VARIABLE AND NON-VARIABLE POWER COSTS

detail of plant operation. He does not have to study boiler efficiencies, engine performance, economical or uneconomical uses of steam, water or electricity. All he needs is the average factory summary from the accounting department of the complete costs of power plant operation for the same period. It is a matter of simple division to establish the power costs per unit of output and to see how it checks with the standard curve. If the power cost is higher than the standard curve indicates it should be, something is wrong, and it is up to the chief engineer to find out and correct the trouble and to explain to the manager why it should have occurred; if the actual costs check with the curve the plant has simply done what it should and no one is entitled to a bonus; if the actual power costs are less than those indicated on the curve for the volume of product, good management and constructive effort has been exercised in the engine

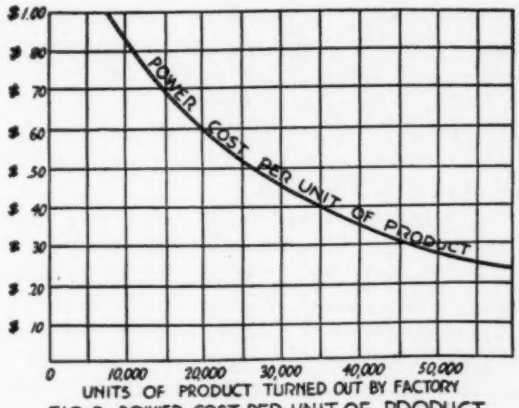


FIG.2. POWER COST PER UNIT OF PRODUCT

and boiler room and the chief engineer and every man under him who helped in the improvement is entitled to a share in his savings.

At this point it may be well to digress for a moment on the point of responsibility of the chief engineer for all items included in the curve under power costs. Warren E. Lewis, whose engineering record certainly makes him a competent witness, is quite emphatically of the opinion that the chief engineer should be held wholly responsible. He states:

"Some engineers have argued that it (the curve) is not a fair basis of payment, that all that the operating engineer can do is to make steam efficiency, run his engines, pumps, heaters, etc., as well as he knows how, and that he has no control of the situation beyond his department. That is partly true and partly not true. The functions of the chief engineer should extend beyond the confines of the engine and boiler rooms. He should spend at least one-third of his time around the plant and he should have an inspector going around the plant continually watching out for improper use of power, light, steam, etc. The chief engineer should be directly concerned in seeing that the process machinery is maintained in an efficient condition. This is particularly true with regard to apparatus that uses steam in any form. If we include in the power plant all the equipment which in any way affects the use of coal, it becomes a comparatively simple matter to place upon the chief engineer the responsibility for the efficiency of the entire power-making and power-using equipment, and for its cost per unit of production.

Now, getting back to the bonus, let us suppose

that the management decides to set apart, say 33⅓ per cent of the savings effected, to be distributed as a bonus. Clearly the chief engineer, individually, is entitled to a certain portion of this and this portion should be determined by the manager. The proportioning of the remainder among the various power plant employes should be practically in the hands of the chief engineer for the reason that he is in constant touch with the work of the various individuals.

That the just proportionment of the bonus among the various individuals will cause the chief engineer some serious study is not denied. It is important, however, that individual rewards be established and that the bonus be not simply divided among the men on a pro-rata basis or with reference to their respective wages. The final results are due to the combined efforts of all of the men and are beyond the control of any one man.

It is necessary, therefore, to judge each man on the basis of his performance of his individual task. If boiler efficiency falls off it may be due to improper firing, in which case the firemen should be penalized, or it may be due to failure to keep the boiler clean, free from soot and scale, in which case the man who does the cleaning should lose all or a part of his bonus, or again the loss in efficiency may be due to leaky boiler settings, a condition clearly outside of the jurisdiction of the fireman and clearly up to the boiler room foreman.

This principle of individual responsibility applies all along the line. For instance, if a new grade of coal is brought into the plant and the chief's assistant engineers do not make it their business to see that the firemen are fully instructed regarding the proper method of firing they are guilty of a breach in duty for which they should suffer. The engineers are, of course, responsible for permitting radiation losses to continue because of failure to insulate pipes and for failure to correct leaky valves, traps, worn gaskets and the like. The engineers or boiler room foreman must be held responsible for economical operation in cutting boilers in or off the line, operating them at economical ratings and banking or killing fires.

When the bonus is not earned by a particular individual it may be due to his own fault in not following instructions, to faulty maintenance, making compliance with instructions impossible, or to faulty supplies. With so many angles to the problem it is evident that close inspection and constant supervision of the work of the individual is absolutely necessary if material reductions in power plant costs are to be made.

It is realized that the program here outlined may seem elaborate. The small plant operator, in particular, may think it complicated, but it is precisely in the small plant that astonishingly good results can be obtained. Admitting elaborateness, this basis of bonus is certainly thoroughgoing. To the writer's mind there is no point whatever to paying firemen a bonus for high CO_2 or for high boiler efficiency if no corresponding effort is made to see that the steam when produced is utilized without preventable waste.

Forestry for the Private Owner

Prepared by the Forest Extension Service of the New York State College of Forestry at Syracuse

This story comprises six chapters, three of which are presented herewith under their respective headings. The balance will be published in a later issue and deal with "Harvesting the Woodlot," "Marketing Woodlot Products" and "Results of Woodlot Management." Though the story treats of the situation in New York State, it contains valuable information and productive ideas, which can be utilized in all other states.—Editor.

THE growing scarcity of timber and the consequential increasing price of all wood products is making the woodlot, the forested areas of private estates and the unimproved land of the farm a big factor in our industrial and economic life. Can the woodlot be made to yield a cash revenue? How and when should it be cut? How can a small amount of logs or sawn lumber be profitably handled? These age old questions are being answered by the New York State College of Forestry in the most practical and scientific way.

The Forestry College is giving to the public the results of its extensive investigations into the wood lot problems—the development, the protection, maintenance, the general management and the marketing of woodlot products. The marketing question has been the chief stumbling block to successful handling of small forested areas. The college staff suggests a plan whereby this difficulty may be overcome.

The importance of the woodlot is not fully appreciated. It has been estimated that New York state contains 12,000,000 acres of land on which nothing but trees could be grown, most of which is unproductive now. Twelve million acres is about half the acreage of the state and unless this vast expanse of idle land—New York state's desert—is made to yield its share the permanent prosperity of the state is impossible. It has also been estimated that approximately 4,000,000 acres are held as woodlots and that the returns from these potential assets are at present infinitesimal. When it is also realized that $85,000,000 is being sent out of the state each year for wood, half of which is paid for freight, the economical importance of the woodlot looms large on the horizon of the present and the future.

The city, county and state indebtedness amounts to approximately $47.50 per acre. The cost of running the state government has increased from $42,000,000 to $140,000,000 since 1909. These facts, together with the necessity for a direct state tax to supplement the insufficient revenue, makes the importance of every acre in the state a vital economic factor, especially is this true when such a vast acreage is lying idle.

Our forefathers derived material, occupation and income from the woodland owned in connection with their farms and the vanishing timber supply will make such products of far greater value in the future than in the past, and since forest crops take time to mature the beginning should be made immediately. It cannot be expected that the high cost of living will ever be reduced to its lowest levels while one-half of the state's productive area is lying idle.

The owner of a woodlot should consider his possession a producing part of his property, one capable of yielding a steady though periodic income. He should be taught that cultivation of a woodlot crop will pay excellent dividends, that the crop produced grows while he sleeps and, since it is not perishable, may be held over for months or years until market conditions are right. He should learn to estimate the amount of timber on his property and its rate of increase. When he is ready to sell his product he should be businesslike in the transaction and demand a fair price. Scores of owners sell their standing timber without knowing how much they have or how much they should receive.

Custom sawing should be revived and, with the increased activity in woodlot work and the growing appreciation of water power, there is little doubt that many of the abandoned dams and neglected mill ponds which dotted rural New York in former days will be restored, and the small mill will again saw lumber and grind meal for the local people. Also the application of electricity and the gas engine is making it possible to operate small mills in county districts or on wooded estates with considerable economy.

The growing activity of the county farm bureaus and the increasing number of farmers' co-operative associations hold forth much promise. Already the co-operative marketing of fruits and vegetables has been tried with remarkable success in certain parts of the country, more particularly among the fruit growers of the far west. From co-operative marketing of field products to co-operative marketing of farm woodlot products is but a short step, and there is no reason why the county agent of the next decade should not advise concerning marketing, prices and methods of selling the products of the wood lot. Where no county or local co-operative buying and selling associations are to be found an aggressive grange might take charge of the marketing. It is not always possible for a single farmer to furnish a sufficient amount of any one kind or size of material to warrant a sale, and in true union there is strength. The right methods of handling wood land can be taught with comparative ease, but it is the belief of many investigators that in the past too little stress has been laid upon financial outcome. With proper marketing conditions the woodlot possibilities in New York are unusually bright. It is largely a question of organization and salesmanship.

Starting the Woodlot

Upon the majority of farms in New York there is some land already covered with forests, so the problem is generally one of improvement. Forests reproduce themselves by seed and sprouts. Practically all the hardwoods sprout during their youth. A clear cutting, the stumps cut low and slanting, will produce the best results in sprouting with regard to species like chestnut, maple, oaks, basswood, etc. Repeated cuttings should be avoided.

For the purpose of improving the mixture in a piece of young sprout land, the bent and slow growing "weed trees" such as hornbeam, blue beech, pepperidge and inferior species like gray birch, black oak should be removed to give more room to the faster growing ash, basswood, tulip poplar, white pine, spruce, red oak, etc.

Many an owner of forest land has spent considerable money reforesting when the simple and cheap removal of gray birch on a natural reseeding ground would have obtained results equally as good.

Regarding the seeding varieties, it may be said that forest trees produce fertile seed at an average age of 35 years. The seed must fall on soil that is adaptable to its germination, otherwise the natural reseeding of a forest cannot progress. The small trees appear often in profusion on the forest floor. The more hardy specimens survive and in the course of from 2 to 10 years the forest will probably need thinning. The less perfect and thrifty trees should be removed to give the more desirable individual trees better opportunity for development.

When the forest is 25 to 30 years of age it is time to begin profitable thinnings. At this period three classes will have formed, the crowding trees of inferior value, the hopelessly suppressed trees and the trees which will form the final harvest. In dense pine and spruce thickets, the "French method" consists in going over the forest at 25 to 35 years and selecting from 600 to 800 specimens. Two hundred and fifty or three hundred of the tallest and straightest are picked for the final crop. All trees interfering with these selected specimens are cut away to hasten the growth, but the trees which are not competing or hindering them are allowed to remain. It is never wise to open too large holes in the canopy, nor to expose too much of the forest floor at one time, as growth will be severely checked. Not more than 25 per cent of the trees should be removed at any one time. The forest floor should be kept dark in order to

secure its maximum production. A similar thinning may be performed every 5 or 10 years.

Pruning is a mooted question. If the limbs are cut close to the truck they will leave loose knotholes. It is on record that successful pruning has been carried on by cutting the limbs 6 to 8 inches from the trunk and 4 or 5 years later by having the dried stubs knocked off. This is said to have left the tree trunk free from knots.

Reforestation of idle lands, however, has many advantages over natural seeding. It puts the idle land to work—there are 7,000,000 acres in New York state within fences that the owners admit are idle. At $5.00 per acre this land represents an investment of $35,000,000, which ought to yield at least $1,400,000 per annum. Reforestation adds to the appearance of the property as well as its immediate market value. Plantations at the end of the rotation will show a profit in excess of 5 per cent compound interest. The financial results of planting non-agricultural land in older countries compare favorably with other long term investments. Reforestation is often carried on profitably in a grown forest. This is called underplanting and is employed where natural regeneration is incomplete. Four-year-old transplants are more desirable for this work. A small tree planted in shady ground near big trees which naturally absorb large amounts of moisture and nutrition will require a stronger constitution to survive these handicaps. Pine transplants can be used in large openings, while Norway or native red spruce can stand more shade. The former requires less moisture than the latter.

This phase of underplanting would consist of setting out 300 to 500 evergreen transplants among hardwoods, placing the plants in groups of 5 to 6 feet from the nearest sprout. Thus a complete stand could be secured at a minimum cost, for the young hardwood sprouts will furnish sufficient side shade to stimulate height growth. The hardwoods could be removed with a brush hook when they threaten to choke out the conifers.

This kind of underplanting should cost not more than $4.50 per acre. The person possessing the land, the time, the equipment, should handle his woodland so as to make it yield. He is in an unusually good situation to grow desirable timber crops at a minimum expense.

Tending the Woodlot

Tending the woodlot should present few difficulties to one familiar with the culture of ordinary crops. When the crop idea is grasped the cultural methods used to carry a forest from youth to maturity will be easily understood.

The soil must be suitable; that is, it should not be used for forests if it is more adaptable to agricultural purposes. The forest should be produced on land impracticable for agricultural purposes. Care must be used in the choice of the trees most adaptable to the soil. Broad-leaf trees, as a rule, demand from one-half to one-quarter the fertility which field crops demand, and they in turn require more than the conifers. The soil should not be less than two feet in depth. Beech, sugar maple, spruce, hemlock and balsam do not require as much light as hickory, poplar, Scotch pine, Norway pine and tamarack. Chestnut, red oak, ash and white pine are intermediate in their requirements. Trees that require little sunshine may grow closer together than trees that demand a great deal of light. In a well managed and properly spaced woodlot very little light should be allowed to strike the ground. Sunlight causes the soil to dry out and encourages the growth of weeds and grass.

Ninety per cent of the rapidly growing parts of a tree are composed of water; hence, trees demand moist soils as a general rule, although sandy and gravelly locations are suitable for Scotch, Norway pines. Hickory and black oaks can endure drought comparatively well, but their root systems require a deep soil foundation. The best quality of timber is obtained from tall trees, free from limbs. Trees should be so placed that the crown of each is in contact with its neighbor, which arrangement makes for tall tree trunks without knot defects.

Seedlings and 4-year-old trees are planted about 1,200 to the acre, the distance between trees should be about 6 feet. When the trees reach a diameter of 2 inches there should be about 2,000 trees to the acre, at 10 inches 235 to the acre, and at 24 inches about 55 to the acre. These figures vary somewhat with the species of trees. Advice will be given by the New York State College of Forestry with regard to particular planting problems for specific species on request.

White pine is the most favored tree from the viewpoint of financial returns and has been planted more extensively than any other species. Among the hardwood trees the red oak is the most desirable. Both these trees exhibit on good soils a quick and rapid growth and the returns from the management are profitable. But in special cases other species are to be preferred.

It is not possible to secure a growth of timber from a woodlot and at the same time utilize it for pasture. Grass in a woodlot is almost an infallible sign of mismanagement. Owing to natural agencies a number of losses in the members comprising the forest community are unavoidable, in fact, desirable. Such losses should be confined to trees that will benefit the growth of the stand. Diseased and dead trees and trees that interfere with the development of other trees may be removed with profit.

Fire is the greatest enemy of the forest. Fifty million dollars in timber values are burned every year in the United States, and it is a safe deduction that a measurable part of this loss is sustained by the

woodlot of the small owner. Fire not only destroys the growing trees, but also the seed germinating in the humus and the young trees that have started toward maturity. A fire renders the soil unfertile and often destroys its productivity for all time. Unusual care should be exercised in the prevention of forest fires, through the establishment of protecting fire line and insisting upon the use of care on the part of every person who enters the woodlot or uses the neighboring land.

A careful watch should be kept against dangerous insects. The most severe depredations in this country could have been controlled with comparatively little effort at the outset. Insects which feed upon the leaves of a tree may be destroyed by a spray of arsenate of lead. Sap-sucking insects may be controlled by the use of contact sprays like whale oil soap emulsion, 1 part to 800 or 1,000 of water. Borers are best guarded against by good forest hygiene—the removal of trees of lowered vitality and, where trees are infected, the removal of such trees at the proper time. In some cases borers may be destroyed in their nests. The white pine weevil causes the top of leaders of the tree to wilt and turn brown. Such tops should be cut and placed in a box or barrel screened at the top to prevent the weevil from escaping. The weevils die, but small parasites which accompany them crawl through the meshes of the screen and prey upon the larvae of coming generations of weevils.

Fungus diseases may be combated by keeping the forest clean of fungi infected trees. Such infected trees should not be kept near the forest, but should be removed and utilized or burned immediately. The chestnut blight has proved unconquerable because of the tremendous development attained before preventative measures were applied. The white pine blister rust can be controlled by burning the infected trees and destroying the current and gooseberry bushes within a radius of 500 feet.

Controlling Combustion on Basis of CO_2 Alone, Unsatisfactory

Falls Far Short of Attaining Best Possible Results

By ROLAND MOELLER, M. E.

FURNACE efficiency should be considered separately from boiler efficiency, and the master key to the proper testing of furnace efficiency is continuous gas analysis, which not only measures the excess air present at all times, but also promptly detects and measures the presence of combustible gases in the flue whenever they appear.

What Savings Are Possible

When coal is burned in a boiler furnace under ordinary conditions, an average of about 65% of the heat generated is used to make steam, 25% goes up the chimney, and the balance is lost through radiation and in the ashes. How important it is to hold the chimney losses down to a minimum becomes evident when we consider that every decrease in chimney losses results in a proportionate saving of heat available for steam making.

To produce steam representing 1,000 units of energy, it is necessary, on the 65% efficiency basis above described, to consume approximately 1,538 units of energy as it comes in the fuel. Now suppose the chimney losses are reduced from 25% to 15%, which is not unusual, and that the 10% thus saved are turned into useful energy, making this 75% of that supplied in the fuel. Then, to produce 1,000 units of useful energy requires only 1,333 units of energy as supplied in the fuel. The difference between 1,538 and 1,333 is 205, and this is nearly 15½% of 1,333, the fuel actually required to carry the load under the more economical conditions. In other words, the saving in fuel represents 15½% of what is necessary under the more efficient operating conditions.

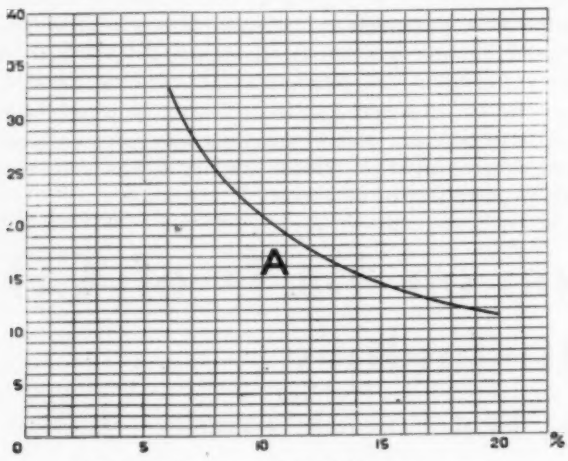
Kinds of Chimney Losses and Their Relative Importance

Heat is lost up the chimney in two distinct forms, namely, the sensible heat of the entire volume of flue gases, and the heat represented by the chemical energy in unconsumed combustible gases. The amount of the sensible heat is a function of the temperature and the volume of the flue gases. The amount of heat lost in the form of chemical energy is a function of the heat of combustion of the unconsumed combustible gases and their volume. The loss of heat represented by a certain percentage of unburned combustible gases in the chimney is much greater than the loss of heat due to excess air represented by an equivalent percentage of CO_2.

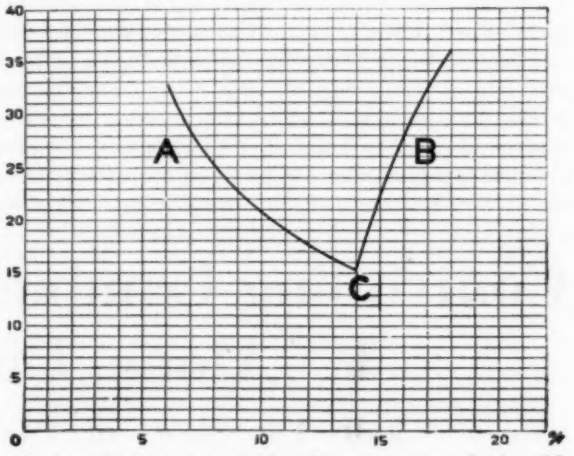
To completely burn fuel, a surplus of air is always necessary over what would be theoretically correct. The amount of this surplus varies constantly, depending upon the many different factors that influence combustion. However, maximum efficiency under practical conditions is attained when there is just enough surplus air to make complete combustion possible, that is, combustion without the escape of combustible gases up the stack. It is that point

where a reduction in the air supply results in incomplete combustion, and an increase in the air supply results in an unnecessary waste of energy through the carrying away of sensible heat by excess volumes of flue gases.

An idea of the magnitude of the fuel losses due to the escape up the stack of combustible gases when the air supply is insufficient as compared to the losses due to the presence of excess air may be gained by a comparison of the curves in Figs. 1 and 2. In Fig. 1 we have a curve showing the fuel losses which take place with varying percentages of CO_2 (varying inversely with the excess air supply) in the flue gases, providing there are no combustible gases present. However, combustible gases (CO, CH_4 and H_2) are bound to begin to form at some point as the percentage of CO_2 is increased (air supply decreased) and, as mentioned before, losses due to the formation of these combustible gases are far greater in proportion to their volume than losses indicated by equivalent proportions of CO_2. This is graphically illustrated in Fig. 2, where the portion CB in the curve represents fuel heat losses that develop beyond the point C where combustible gases begin to form as the percentage of CO_2 is still further increased by reducing the air supply.



Ideal conditions—no combustible gases present
Figure 1.



Practical conditions—where combustible gases appeared when CO_2 passed 14 per cent
Figure 2.

Per cent of CO_2 in flue gases—increases with decreasing air supply

The point C is the critical point. It is the point where combustion takes place with the greatest economy in fuel consumption. It varies not only in different furnaces, but varies constantly in the same furnace.

The curves shown were plotted from generally accepted average values. On that basis, the following comparisons are interesting. Let us assume that when CO_2 is 14%, combustion is taking place under conditions of maximum efficiency in the furnace. The unavoidable loss under these conditions is 15.3% of the total fuel used. Let us assume that only 1% of combustible gases forms for every per cent increase in CO_2 beyond this point. Taking into account the heating value of these combustible gases, calculations show that when the percentage of CO_2 reaches 15, the fuel loss is 22%, and when the percentage of CO_2 has reached 16, the percentage of fuel loss becomes 28.

What CO_2, CO, CH_4 and H_2 in the Flue Gases Tell About Combustion

Many power plant engineers consider it foolish to place much confidence in CO_2 readings, and make it a general rule never to allow the CO_2 present to exceed 10 to 12%. Others put it as low as 8 to 10%. Under these conditions, there is likely to be a great waste of fuel due to the avoidable escape of sensible heat up the chimney. In contrast with these there are authorities who claim there is no danger of having combustible gases escape unconsumed before CO_2 reaches a point above 15%.

The fact of the matter is, combustible gases may appear with any percentage of CO_2, and depending on CO_2 records alone is therefore decidedly misleading and illusory. It is quite possible to have large volumes of combustible gases (CO, CH_4 and H_2) present simultaneously with a low percentage of CO_2 as well as a high percentage of CO_2. For example, if the fire in one part of the furnace is very thick or dirty, CO would be generated in that part and escape unburned because not enough air would be going through. If, at the same time, there is an air hole in another part, air would rush through there unused. Under these conditions CO would be found present at the same time that the record would indicate excess air by a low CO_2 reading.

The percentage of CO_2 for economical combustion may vary considerably from time to time in the same furnace with the rate of combustion, method of firing, thickness of the fire bed, distribution and character of the fuel, draft, formation of ashes, dirt and clinkers, and many other influences which are subject to irregular variations, and which have a decided

effect upon the completeness and efficiency of combustion with any given air supply.

Generally speaking, low CO_2 indicates excess air, but may also indicate that the air is poorly mixed, giving rise to a simultaneous formation of CO. It is therefore not desirable to attempt to secure a high percentage of CO_2 by cutting down the draft alone. A high percentage of CO_2 can be obtained with practically any draft, so long as it has the proper relation to the fuel bed resistance.

On the other hand, the losses due to the formation of combustible gases which are allowed to escape up the chimney without being burned are frequently much greater than the losses due to excess volumes of air, because it is quite possible to reach a very high percentage of CO_2 while simultaneously producing large volumes of combustible gases (CO, CH_4 and H_2).

Insufficient air supply is the most general cause of the presence of CO in the stack. CO may, however, be present due to the poor design of the furnaces, improper methods of firing, the coal being of a character not adapted to the equipment with which it is burned, poor mixing of the combustible gases with the air and low furnace temperature, which causes gases to be cooled down below the ignition point before combustion is complete.

Occasional snap tests for CO with hand instruments to check up the CO_2 recorder have therefore proven entirely deficient in properly controlling combustion. Recording CO_2 alone has never, under any condition, given results even approaching the possibilities of economical combustion, and it is positively known that the maximum economy in fuel consumption cannot be realized by any of the old fashioned methods.

acts very much like a gas producer. In a fuel bed 12″ thick, where no secondary air was supplied, practically all the oxygen was consumed 4½″ from the bottom of the fire. At this point CO_2 reached 14% and combustible gases registered 10%. About 26% of the gases leaving the top of the fire were combustible gases, while the percentage of CO_2 was reduced to 7. Le Chatelier states that CO_2 generally reaches a maximum at a height in the fuel bed ten times the diameter of the coal pieces. From this point on reduction of CO_2 takes place.

The combustion of coal in an ordinary boiler furnace thus takes place in two stages. In the first stage, the fuel bed acts as a gas producer, producing CO and other combustible gases in large volumes.

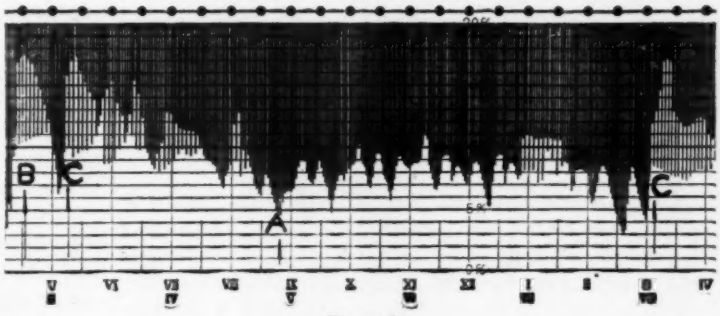


Figure 3.

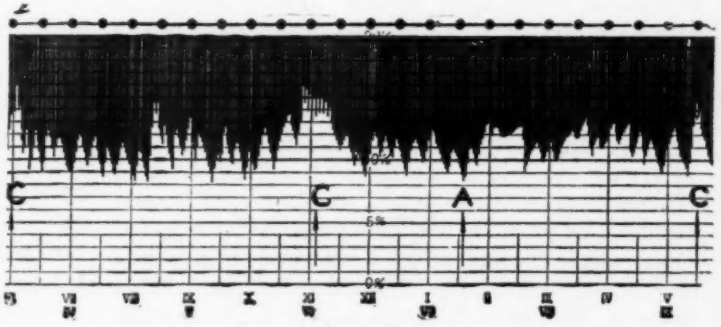


Figure 4.

Facts About Combustion in a Furnace Not Generally Recognized

The oxygen used in the process of combustion in a furnace comes from two sources, namely, the primary and the secondary air supply. The primary air supply is that which flows through the combustible material in the fire bed. The secondary air supply is that which is admitted to the combustion chamber above the fire through holes in the fire bed, the fire doors, through leaks in the boiler settings, etc. It supplies the free oxygen necessary to oxidize the combustible gases generated in the fire bed.

The Bureau of Mines has conducted exhaustive experiments to determine what actually happens when coal is burned in a furance. It was discovered with one fuel, that when the fuel bed is over 4″ thick, and free from air holes, a furnace without secondary air

In the second stage these combustible gases are mixed with the secondary air and the carbon in the CO and other combustible gases is oxidized to CO_2, and the hydrogen combines with oxygen to form water vapor.

Contrary to the generally prevailing impression, the volume of the secondary air required to burn coal in a furnace is greater than the volume of the primary air. If the coal were all carbon, the volume of the secondary air required under ideal conditions would be the same as the volume of the primary air In the first stage of combustion the reaction would be $2C + O_2 = 2\ CO$. In the second stage it would be $2\ CO + O_2 = 2\ CO_2$. In other words, the volume of air required to convert the carbon into CO in the primary stage is the same as the volume of air required to burn the CO into CO_2 in the secondary stage.

However, there are other gases than CO which come off in the first stage of burning coal. To burn these additional gases, secondary air is required. Inefficient mixing of the combustible gases in the combustion chamber with the secondary air supply gives rise to still further demands for excess secondary air, that complete combustion may take place. How much secondary air is required depends on the furnace design, kind of stoker, method of firing, kind of fuel, etc.

Nobody can tell anything about the volume of the secondary air, where it all comes from, how much enters through the various known channels, or what its proportion to the total air supply is. It is generally recognized, however, that the one safe rule is to keep it at the least possible minimum necessary to insure complete combustion of combustible gases. This can only be done by a constant watch for the appearance of combustible gases in the flue, while holding the percentage of CO_2 at the maximum point which can be maintained without the appearance of such combustible gases.

Holes, ashes, clinkers, or dirt in the fire, thickness of the fuel bed, draft, length of time of opening of fire doors and regulation of dampers—all cause wide and irregular fluctuations in the amount of secondary air admitted. While the amount of this secondary air has such a decided and important effect on the economical combustion of the combustible gases which are formed in the fire bed, it is a most bewildering and hopeless task for the fireman to attempt to control it scientifically, or to form any conclusions, or to make estimates based on direct observation regarding the proportion or amounts of this secondary air entering at any time. To achieve efficient furnace results, some clear, simple means should therefore be provided for telling him just how much excess air is present at all times, and to give him prompt warning of the appearance of combustible gases in the chimney. Such means act as a guide for the fireman, enabling him to intelligently regulate his fires and to manipulate to the best advantage the controllable elements which determine the admission of excess air to the combustion chamber.

The best method of firing a particular furnace, and regulating the air draft and dampers, can only be determined by trying various ways and means and carefully watching the results recorded from the analysis and recording of both CO_2 and combustible gases. Only through such a procedure can the fireman learn by experience what must be done, and what must be avoided to give the maximum percentage of CO_2 at all times without the loss of combustible gases up the flue. Without such a continuous and complete record of both CO_2 and combustible gases, or with a record of CO_2 only, he is working blindly in the dark, and can tell nothing about the results of his various efforts towards attaining higher combustion efficiency.

Correct mixing of the air and the volatile combustible products of the furnace is a matter of greatest importance, and represents one of the most difficult problems of design the combustion engineer has to contend with in his efforts to cut down the amount of excess air necessary to insure complete combustion and to reduce the possibilities of having unconsumed combustible gases escape up the chimney. Stratification, having the process of mixing take place too slowly, or premature cooling of the mixture below the ignition point—all lead to waste.

How nearly combustion in practice can reach the ideal is well represented in certain boiler plants where blast furnace gas is the fuel. By means of a multiplicity of interspersed small air and gas orifices such a thorough, intimate mixture of the fuel and air is obtainable that the percentage of excess air necessary to insure complete combustion has been practically reduced to zero. On the other hand, it is not at all uncommon to find in small coal burning boiler plants where hand firing is used, that the Co_2 in the flue gas analysis registers as low as 4%, showing the presence of 420% excess air.

In a paper by Ambrose N. Diehl on "Modern Methods of Burning Blast Furnace Gas Under Stoves and Boilers," the following statement appears: "In view of the fact that 1% of CO in flue gas containing 18% of CO_2, adds approximately 6.5% to the losses, and a proportionate larger amount in more dilute gases, it becomes apparent that a high degree of accuracy in the CO determination is very desirable. For this reason, efficiencies based on analyses of a CO_2 recorder are not dependable." He states further that constant gas analysis and intelligent supervision are the principal factors in obtaining continuous good efficiency and control without changes in equipment. Similar statements hold good where coal is the fuel.

Essentials in the Attainment of Maximum Economy in Combustion Control

Only by continuously recording the percentage of CO_2 as an indicator of the amount of excess air present, and also detecting and clearly recording the presence of combustible gases (CO, CH_4 and H_2) immediately they are present, can effective combustion control be established. By no other means is it possible to avoid unnecessary loss at all times in the combustion of fuel, either due to an excess supply of air or through the loss of combustible gases up the chimney.

Graphic records of such a combination of simultaneous gas analyses, considered in conjunction with other records and the various functions in boiler room operation, not only point the way toward improving combustion in a given furnace, but are also an indispensable guide when, to improve combustion, alterations or reconstruction of a furnace are considered. At such times, the grate, combustion space, baffles, arches, wing walls, dampers, settings, chimney or

mechanical draft, etc., all come under consideration.

Recently an instrument has been perfected and placed on the market, which not only accurately analyzes and records the percentages of CO_2 present at all times in flue gases, but also promptly detects and clearly records on one and the same chart the presence and the approximate proportion of combustible gases whenever they appear.

Mr. Olof Rodhe states that his experience with a great many plants both in America and Europe has conclusively proven that "economical combustion is possible only when combustion control is based on records indicating not only excess air, but also the presence of combustible gases due to an insufficient supply of air. Combustion control on the basis of CO_2 alone, with an occasional snap reading of CO is not effective. Only by simultaneously and continuously analyzing and recording the percentages of both CO_2 and combustible gases present in the flue at all times can the maximum economies be attained in fuel consumption." These requirements have been successfully met by a new gas analyzing instrument of which Mr. Rodhe is the inventor.

One of the prime purposes of this device is to detect the presence of combustible gases in the flue immediately upon their appearance, and to record accurately the percentage of CO_2 present **at that particular time.** It is so sensitive and accurate in the performance of this function, that it will unfailingly detect and record with the least possible delay the presence of even such minute fractions as one-tenth of one per cent of combustible gases in the products of combustion. Even this slight proportion is clearly recorded on the chart, so its presence is easily detectible by the operator at a glance. The presence of combustible gases once established, the accurate determination of their actual percentages is not of any importance. The instrument indicates approximately the degree in which they appear, and that is sufficient for the guidance of the firemen. The actual percentage present is rarely less than two thirds, or more than equal to the amount recorded on the chart.

Even where the old conditions were considered as most favorable, the installation of these instruments has repeatedly demonstrated that incomplete combustion was prevalent to a far more serious degree in modern boiler plants before the new method of control was adopted, than was ever suspected.

Fig. 3 represents a diagram made by one of these new double-recording instruments. The lower contour of the diagram accurately represents the percentages of CO_2 present at all times. The lighter areas in the diagram indicate the presence of combustible gases (CO, CH_4 and H_2). The proportion of combustible gases present is roughly indicated by the height of the lighter areas at any particular time.

Looking closer at this diagram, it will be seen that at the point C farthest to the left, combustible gases began to form when the percent of CO_2 was 10, and the amount of combustible gases formed increased rapidly, as the percentage of CO_2 increased to 11%, only to vanish again when the percent of CO_2 was again reduced to 10%. At point C to the right, combustible gases begin to form again, this time, however, when CO_2 is only 8½%. This shows that between 4:30 in the morning and 3 o'clock in the afternoon, changes have taken place in the furnace conditions such that while combustible gases began to form when CO_2 was 10% early in the morning they began to form when CO_2 was only 8½% in the afternoon. Should the operator keep CO_2 at 10% all day long, it is evident that serious losses might take place as in this case between 3 and 4 o'clock in the afternoon, as indicated in the right hand part of the diagram. That is what happens when the maximum allowable CO_2 is determined for an indefinite period by a snap CO test.

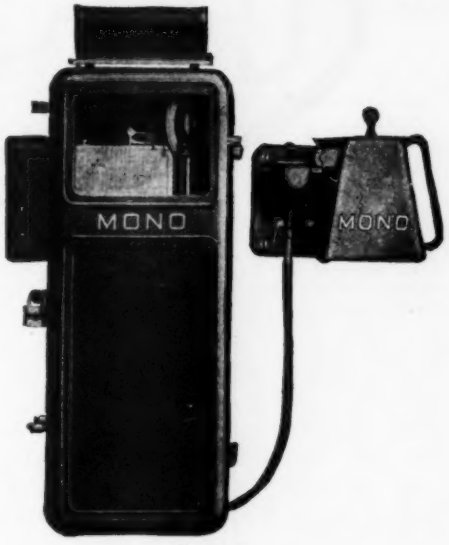


Figure 5.

Diagram 3, which we have just discussed, shows the condition found in a boiler plant at the time the instrument was first connected, and the furnace was operated on the old principle. Certain changes were made in the furnace, the nature of the fuel and the method of firing, with the result that conditions as illustrated in diagram 4 were obtained. In this diagram it is seen that CO_2 could be carried to a point as high as 13% without the formation of CO. In other words, the critical point was raised several points higher on the diagram, the reduction in air supply without formation of combustible gases resulting in a saving of 20% in fuel. With such a record always before him, the operator is always in a position to follow closely any variations in the positions of the critical point and knows immediately when combustible gases begin to escape unburned up the chimney. Where the dark contour goes below the critical point, too much air is supplied, or there is improper distri-

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bution of air. Where, on the other hand, the dark contour rises above the critical point, that is, the point where light areas begin to show, the supply of air is insufficient.

General Characteristics of the New Combustion Control Instrument

The apparatus (see Fig. 5) is driven by water pressure of about 10 lbs. per square inch. Before entering the instrument, the gas samples from the flue are pulled through a filtering system, which removes all traces of soot and dirt. They are then drawn into and forced through the apparatus by a mercury piston. There are no mechanical valves, such functions as these ordinarily fulfill being performed by various kinds of mercury seals, traps, etc.

Samples of gas are forced alternately through two routes; one leading directly through a caustic potash tank where CO_2 is absorbed, and the other first through an electrically heated furnace wherein the combustible gases are oxidized to CO_2 and H_2O, and then through the caustic potash tank. Samples that are forced through the caustic potash tank only give the readings for CO_2. Those that are first forced through the electrically heated furnace and then through the caustic potash tank, give readings of CO_2 plus combustible gases. The difference between any two successive readings is proportional to the amount of the combustible gases present at the time the analyses are made.

In the electrically heated furnace, the oxygen necessary to oxidize the combustible gases, CO, CH_4 and H_2 to form CO_2 (which is later absorbed in the caustic potash tank) and water (which is condensed) is usually taken from the air which is almost invariably present in flue gases, even when combustible gases are present. When such free oxygen is not available, oxygen is taken from copper oxide provided in the furnace for that purpose. The copper oxide, however, probably seldom acts as anything but a catalytic agent and need never be renewed.

Should any of the copper oxide be reduced to plain copper to oxidize combustible gases in the process of analysis, it is reoxidized by oxygen present in the flue gas samples passing through the electric furnace later.

To diminish the lag between the time when the gas leaves the flue and the analysis is recorded on the chart, small communicating tubes are used. The lag between the time that the sample is taken from the flue to the time that it is recorded by the instrument is about 3 minutes where the distance between the instrument and the point where the flue is tapped is about 60 ft. and the instrument is making about 40 analyses per hour.

These instruments are made to produce records covering a range of either 20, 25 or 40%, according to the purpose for which they are intended. The 20% range is the most common. A range shifter can be provided so that the position of the range is adjustable, that is, the 20% range, for example, can be set between 0 and 20, 5 and 25%, 10 and 30%, or between any other limits at the will of the operator.

The recording pen, when at its highest position, comes into contact with an ink container having a two weeks' supply of ink. The ink in the pen is automatically replenished every time it returns to the high point on the chart.

The apparatus is practically dustproof and requires only a slight amount of attention, which consists in winding the clock once a week, replacing the caustic potash solution two or three times a month, replenishing the ink supply twice a month, and putting in new rolls of paper once every two months.

Accuracy of Records and Their Value

The readings indicating the presence of combustible gases are exaggerated, if anything, by this gas analyzing instrument. This is quite an advantage in a danger signal. The losses due to the appearance of combustible gases are much greater than the savings due to an equivalent increase in CO_2 as registered on the chart, and an exaggerated record of their presence on the chart has a favorable effect on the fireman. Since it is aimed never to have combustible gases present at any time anyhow, there would be no object in having exact records of the percentage present where they do appear. An approximate, and preferably an exaggerated record, is all that is necessary, and this is the kind of record made by this instrument.

Why the records of percentages of combustible gases are not exact, is explained in the following paragraphs. The discussion of these phenomena is, however, of little practical importance, since the object of prime importance is to detect and record combustible gases as soon as they are found and to know exactly what the percentage of CO_2 is at that time. While the degree in which combustible gases are present need be known only approximately, the percentage of CO_2, on the other hand, should be accurately known at all times and particularly at the time combustible gases begin to appear, so the fireman may always know how high he may carry this percentage of CO_2 under the best conditions without running into the danger of generating combustible gases and how near he is to this point when combustible gases appear at other times, so he may handle his furnace accordingly.

Where CO, CH_4 and H_2 are oxidized through the addition of oxygen taken from the copper oxide in the electric furnace, the volume of the flue gases is not affected by their passage through the apparatus other than by the removal of these gases. The reactions are as follows:

$$2CO + 2CuO = Cu_2 + 2CO_2$$
$$2H_2 + 2CuO = 2H_2O + Cu_2$$
$$CH_4 + 4CuO = CO_2 + 2H_2O + 2Cu_2$$

After leaving the electric furnace, the H_2O is condensed, and the CO_2 is absorbed in the caustic potash

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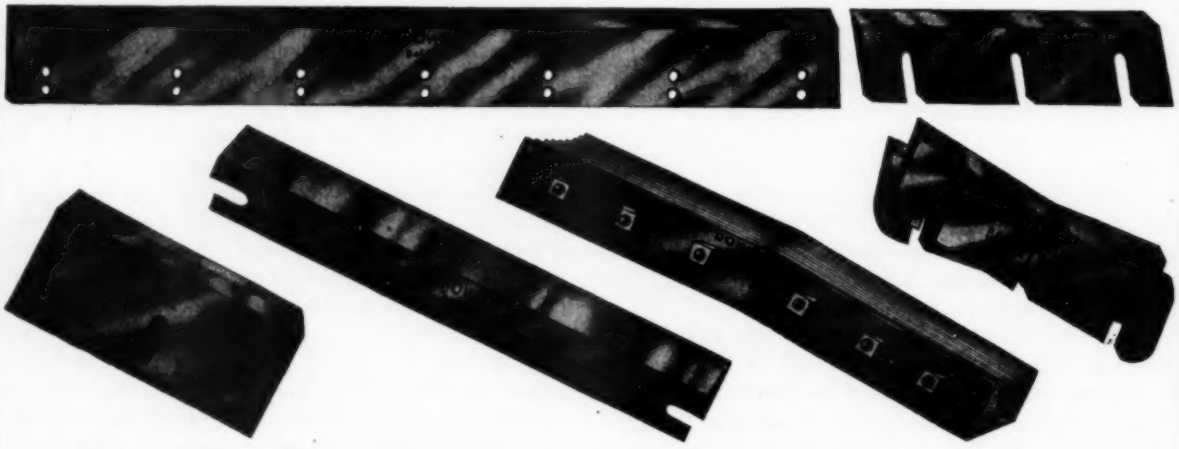

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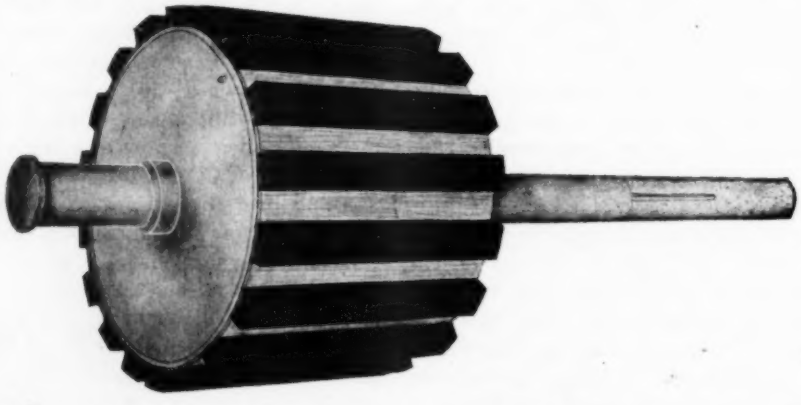

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Beloit, Wisconsin, U. S. A.

solution. The records of combustible made by the instrument under these conditions are therefore in exact conformity with the proportions of these gases removed. A large excess of copper oxide is always carried in the furnace, so that the apparatus can run a long time analyzing great quantities of combustible gases continuously without running short of oxygen, should no free oxygen be available in the flue gases for extended periods.

When, in the process of oxidizing CO, the oxygen is supplied by air present in the flue gas sample, the chemical reaction is as follows:

$$2CO + O_2 = 2CO_2$$

Two volumes of carbon monoxide combine with one volume of oxygen to form two volumes of carbon dioxide, which is later absorbed in the caustic potash solution. Since three volumes of gas are thus removed to record two volumes of CO, the actual volume of CO present is, under these conditions, only two thirds of what the record shows.

When CH_4 is oxidized with free oxygen from the air present in the flue gases, the reaction is as follows:

$$CH_4 + 2O_2 = CO_2 + 2H_2O$$

One volume of CH_4 plus two volumes of oxygen produces water, which is condensed, and one volume of CO_2 which is later absorbed in the caustic potash tank. In other words, three volumes of gas are removed from the sample for each volume of CH_4. Under these conditions, the percentage of CH_4 present is just one third of that recorded by the instrument.

When hydrogen is oxidized through the addition of oxygen in the air, the following chemical reaction takes place:

$$2H_2 + O_2 = 2H_2O$$

The water is condensed and removed in liquid form. Three volumes of gas (2 of hydrogen and 1 of oxygen) are thus removed for every two volumes of hydrogen present. Consequently, the amount of hydrogen actually present is under these conditions but two thirds of what the instrument indicates.

Sufficient free oxygen is almost invariably present in the flue gases to oxidize the combustible gases there without resort to the oxygen supplied by the copper oxide. Even in the rare instances where this is not the case, many years of experience and innumerable tests in plants of every description under all kinds of conditions have conclusively demonstrated that the readings of the instrument are never affected by the removal of free oxygen from the gas samples to reoxidize Cu to CuO for more than one or two analyses after the combustible gas has disappeared from the products of combustion, and the increase in the length of the lighter areas which record combustible gases on the chart resulting from the absorption of oxygen from the flue gases is therefore negligible. The copper probably has more of a catalytic action, and incidentally forms a reserve supply of oxygen on which to draw in emergency only.

What is of prime importance is the immediate detection and recording of combustible gases the instant they appear, and an accurate record of the CO_2 present at that particular time, and at all other times as well. The slight lag which might appear at rare intervals in recording the time when combustible gases cease to appear does not matter.

The CO_2 records of the machine are invariably accurate. This makes possible the accurate determination of the critical point at any time under any conditions. The critical point, C, as mentioned before, is the highest percentage of CO_2 that can be reached in a given furnace without having combustible gases begin to appear. The higher it can be raised, the more economical is the process of combustion. Knowing its maximum from the clear and accurate records of the instrument, the fireman can always tell the degree to which he is approaching ideal conditions. Should combustible gases appear at a point below the critical point, he knows that his dampers, fire doors, or the fire itself needs immediate attention, which experience soon teaches him to give to the best advantage.

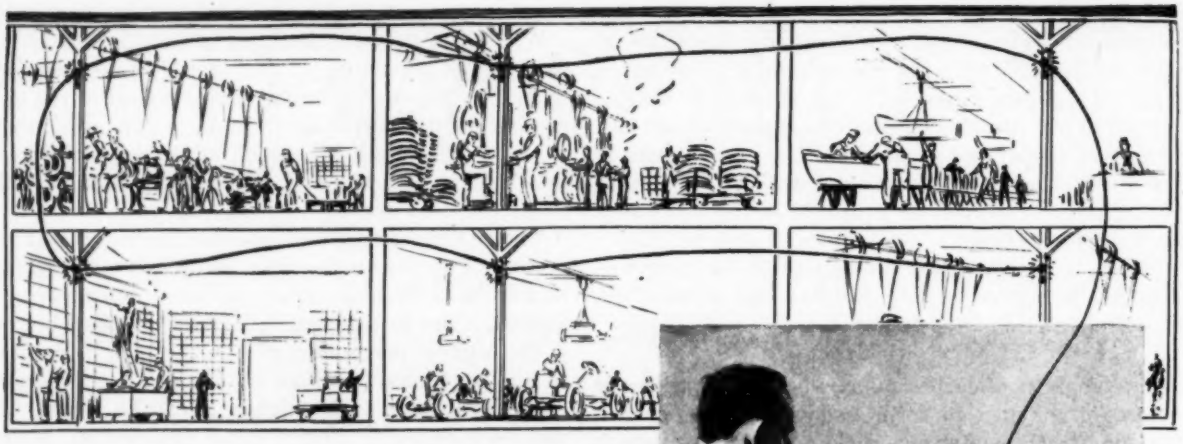
The plant executive is given a permanent record which gives him the data necessary to compute the degree of efficiency attained in the firing of the furnaces, and offers him every opportunity to intelligently appreciate the efforts of the firemen. It enables him to give valuable suggestions and advice and to cooperate with the boiler room force most effectively towards promoting fuel economy.

A New Apron Material

IN the manufacture of paper it is essential that the stuff goes from the flow box to the breast roll as smoothly as possible. The problem of the papermaker is to transfer the pulp in an even sheet. The slightest unevenness in the way the fiber is spread over the apron on to the screen will show in an uneven product. If it is true that a chain is no stronger than its weakest link it is also true that a Fourdrinier machine is no more efficient than its apron.

Formerly paper manufacturers used a coated cloth, usually linseed-coated drill. The fiber in the cloth was kept constantly wet when the machine was running, particularly after the protective coating had begun to wear off. But when the machine was stopped the water-impregnated fibers of the cloth were exposed to the action of the air and shrank. As a result a "buckle" or hump appeared in the apron. When the machine was started again, if this defect had not been remedied, the pulp could not flow evenly over this "buckle" or hump and the finished paper had a thin streak where the hump caused an uneven flow.

The under side of the apron is laid on the constantly revolving, endless, bronze wire screen. The conse-



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"When the official I am calling hears his signal, he goes to the nearest 'phone and I tell him what is wanted or connect him with the person telephoning him.

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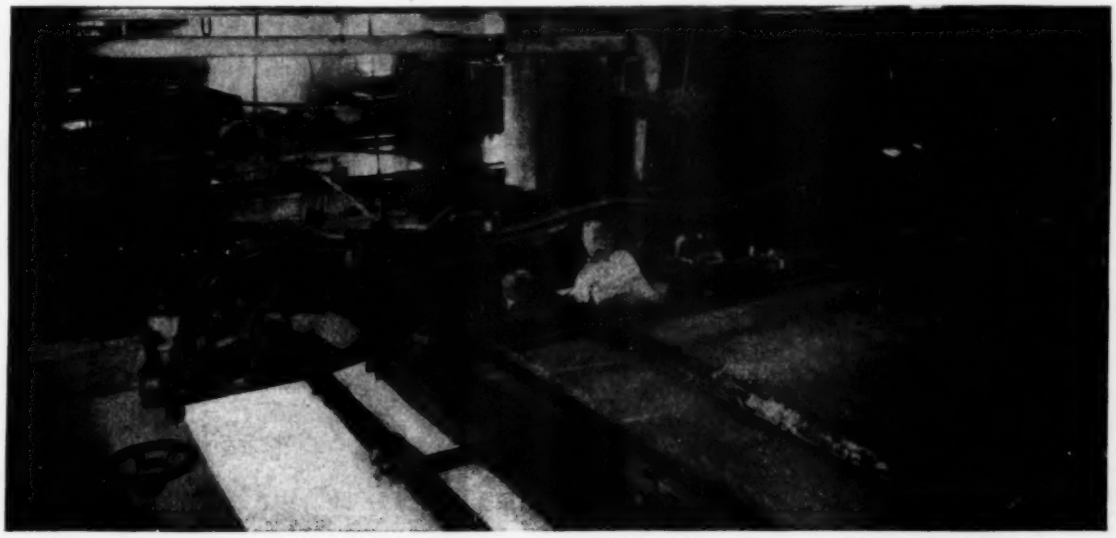
quent friction wears away whatever coating has been placed on the cloth, leaving the fibers at the mercy of the constant immersion. Sometimes the abrasion of the wire makes the cloth so thin that it collapses, or in making repairs to it the workman inadvertently puts his finger through the thinned material. Abrasion is also responsible for frayed edges, another source of annoyance and trouble to paper manufacturers.

Whether buckled, frayed or broken, the apron has to be replaced. This means shutting down the machine, the loss of valuable time, the waste of much material and the cost of another apron. Fabrikoid, doubly impregnated with pyroxylin, is now being used as an apron on papermaking machines. It has a much longer life than ordinary aprons; the material stands greater wear from the rasping, file-like bronze wire, and buckling, if not eliminated, is reduced to a minimum. The apron has been tested extensively in the Augustine mills of the Jessup & Moore Paper Company, Wilmington, Del. According to these manufacturers the fabrikoid apron has proven thoroughly satisfactory, more convenient and much more economical than those previously used.



The double impregnation of the fabrikoid apron renders it waterproof. Even when the protective coating is worn off the water can have no effect on the fibers, which are themselves impregnated with pyroxylin. Papermakers know that when the machines are shut down it is necessary to protest ordinary aprons from drying so as to prevent shrinkage. This is generally done by keeping wet blankets on the cloth until the machine is started again. Even with this protection the aprons shrink and buckle.

At the Augustine mills, while the fabrikoid apron was being tested, the machines were shut down. The apron was left exposed to the action of the air without protection, but after several days' time, when the machines were again started, the material was found to be as good as new. The fabrikoid did not shrink or buckle when it dried. Fraying is almost impossible with the fabrikoid apron. The fibres are so closely interwoven and the pyroxylin solution becomes such an integral part of the fabric that it can stand a maximum amount of wear and abrasion. Outwardly there is very little difference between several yards of coated cloth and several yards of fabrikoid when used as the apron of a papermaking machine. But the manufacturer knows that in his business, as in every other, "many a mickle makes a muckle," and fabrikoid is one of the little things that count.

A Man's Prayer

"Teach me that 60 minutes make an hour, 16 ounces one pound and 100 cents one dollar. Help me so to live that I can lie down at night with a clear conscience, without a gun under my pillow and unhaunted by the faces of those to whom I have brought pain. Grant that I may earn my meal ticket on the square, and that in earning it I may do unto others as I would have them do unto me. Deafen me to the jingle of tainted money and to the rustle of unholy skirts. Blind me to the faults of the other fellow but reveal to me my own. Guide me so that each night when I look across the dinner table at my wife, who has been a blessing to me, I will have nothing to conceal. Keep me young enough to laugh with little children, and sympathetic enough to be considerate of old age. When comes the day of darkened shades and the smell of flowers, the tread of soft footsteps and the crunching of wheels in the yard—make the ceremony short and the epitaph simple—'Here Lies a Man.' "—Anon.

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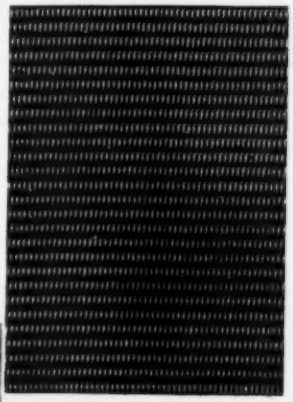

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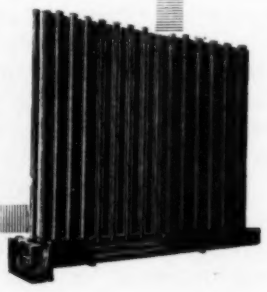

Cooking Time Shortened by Preliminary Impregnation in Production of Sulphite

By VANCE P. EDWARDES*

Presented at the Sixth Annual Meeting of the Technical Association of Pulp and Paper Industry on April 13, 1921, at the Waldorf-Astoria Hotel, New York.

THE importance of reducing the cooking time in the sulphite process without injuring the quality of the pulp has led to many innovations in pulping methods. Stronger acid, dry wood, superheated steam, together with various semiautomatic devices have aided in the shortening of cooking time. For a time the use of acid fortified with liquid sulphur dioxide looked very promising, and excellent results were obtained on a semicommercial scale with acids analyzing 10 to 15 percent total sulphur dioxide. At the present time, however, economic conditions do not warrant the use of liquid sulphur dioxide upon a large scale either in the acid system or when charged directly into the digester.

In the course of regular cooking procedure the general practice is to come up to pressure rather slowly, say in two hours or more, or to let the cook soak for a time at a comparatively low temperature. These precautions insure thorough penetration of the chips by the cooking liquor before the temperature is increased to a point where burning could take place within the chips.

It has doubtless occurred to many that penetration could be obtained by methods similar to those used in wood preservation and, in fact, such a procedure using alkaline liquors was patented in 1867. Kress and Wells in their modified method of pulping by the sulphate process[1] make use of the same principle and the writer knows of commercial attempts to adopt forced impregnation of sulphite pulping.

We were, therefore, very glad when an opportunity was presented through cooperation with Mr. D. C. Andrews, of the Northwest Paper Company, Cloquet, Minn., to attack this problem and carry the experiments to such a point that we could definitely determine the value of forced impregnation as applied to the sulphite process.

Preliminary Tests

The procedure suggested was to maintain a vacuum on the wood as long as desired and to draw the cooking acid in under vacuum, afterward applying hydrostatic pressure to force the acid into the wood. It was expected that the time elapsing before the cooking temperature was reached would be materially shortened, and that higher yields and more evenly cooked pulp would be obtained. Preliminary experiments were made upon aspen and white spruce blocks approximately the size of the tree trunks in order to include heartwood and sapwood in the test.

Autoclave Tests

The test blocks were charged into bronze autoclaves and subjected to a vacuum varying from 17 to 25 inches for 10 to 30 minutes time. Acid was pulled in until the autoclave was full, then pressure of 75 to 80 pounds was applied for 15 minutes, after which the pressure was released, the autoclave opened, and the blocks examined.

Difficulty was experienced in determining the exact limits of penetration and it was decided to use a dye which it was hoped would penetrate along with the acid and serve as an indicator. Various dyes were tried but the results obtained were not entirely satisfactory. It was felt that the dye indicated only the minimum depth of acid penetration and in certain instances it was very plain that the color had filtered out. Similar results have been observed in wood preservation. Spraying the freshly exposed inner surface of the blocks was attempted, but with unsatisfactory results, principally because the sulphur dioxide gas arising from the acid did not permit the formation of a sharp line of demarcation.

The blocks under test were 5/8, 1 and 2 inches in length with the grain and in no case was complete penetration observed. A photograph of the treated blocks was not satisfactory principally because of the colors used, and it is therefore impossible to illustrate the results of the various experiments. In the case of aspen it seemed to be definitely settled that the heartwood offers more resistance to penetration than sapwood, although channels of heart rot often permitted the treating liquor to penetrate thoroughly. Spruce did not exhibit the same differences and even penetration was obtained.

The effect of high acid temperatures obtained by heating the autoclave with gas in every case was to burn the interior of the blocks. Very possibly this was due either to the method of heating or too rapid rise of temperature. The advantages possible through the use of preheated acid are of far too great importance to allow the investigation to end with these few experiments but this laboratory lacks the equipment to carry on the necessary experiments.

Treating Cylinder Tests

Several additional tests were made in a glass treating cylinder designed to permit observation of the

*Engineer in Forest Products, Forest Products Laboratory, U. S. Forest Service, Madison, Wisconsin.

[1] U. S. Patent, No. 1,266,957, May 21, 1918.
Report of Sulphate Pulp Committee, by Otto Kress, *Paper*, May 22, 1198.

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behavior of preservatives when used for protecting wood against decay. Kerosene was first tried, and although far lower pressure was used than in the autoclave experiments complete impregnation was obtained, both on aspen and spruce blocks. This was undoubtedly due in a large measure to the low viscosity of the kerosene, which point will be discussed later. Experiments were next made weighing the blocks before and after treatment. In general, it was found that they had taken up impregnating liquor that weighed about one and a half times as much as the wood blocks. All tests except the first were made with water colored red with an acid dye, but the same difficulty of determining the extent of impregnation was experienced as formerly.

The aspen wood used varied from 70 to 85 percent dry and had been stored for at least a year in the pulp mill yards. No attempts was made to determine the effect of moisture upon the rate of penetration, but in wood preservation using either creosotes or water solutions increased moisture content of the wood decreases both the ease of penetration and amount of treating liquor absorbed. Tables giving in detail the results of the preliminary impregnation experiments are not felt to be of sufficient importance to justify their inclusion in this paper.

Semi-Commercial Trials

In spite of the rather negative results obtained by the autoclave and cylinder impregnation tests, it was decided to proceed with semi-commercial trials. Accordingly, the experimental sulphite digester was equipped with a pump capable of maintaining about 27 inches of vacuum and also a means of charging the acid into the digester through the bottom after the cover had been bolted on. The procedure in the first few cooks was to load the digester with clips, pull a vacuum for the desired time, charge the acid under a vacuum until the digester was full, then apply pressure by means of a small boiler pump. Generally, 15 minutes elapsed between the time the pump was started and 75 pounds pressure reached. This pressure was maintained until the pressure drop indicated that the wood had absorbed practically all the acid possible. In the first cook the excess acid was not run back into the acid storage tank and this resulted in difficulty arising from hydrostatic pressure. In the later cooks some acid was drawn off and an attempt made to measure the gallons of acid forced into the wood but with unreliable results. The difficulty in operating and generally unsatisfactory results obtained from using vacuum followed by hydrostatic pressure led to the abandonment of this method of impregnation, and the remaining cooks were made using air pressure alone. More reliable impregnation figures were also obtained by using the calibrated glass liquor gauge on the digester. It was found that the percentage of impregnation was as great when air pressure alone was used as when the wood was subjected to preliminary vacuum. Numerous wood preservation experiments made by the Forest Products Laboratory confirm this finding, although slightly more time was generally required to reach a certain saturation when no preliminary vacuum was used. The main effect of the vacuum, however, is to permit the wood to hold more impregnation liquor after pressure is released, but as in the method described the pressure is maintained throughout the cook; this point is of no particular interest. The procedure finally adopted was to charge the digester with chips, run in the acid at the top, completely filling the digester, and after the cover was bolted on, putting 75 pounds air pressure on the digester. At the same time steam was started and it was found unnecessary to maintain the connection with the air line for more than a few minutes. The cooking curves followed differed from the usual practice of the laboratory, but this was necessary because of the comparatively low pressure which commercial digesters can withstand. In general, acid composition was kept constant, the variables being temperature and time. To permit a comparison the two cooking curves are included.

Detailed cooking data are given in Table I and strength tests, together with condensed cooking in formation, in Table II.

Cooks 448 to 451, inclusive, 475, 478 and 476 are standard cooks and made for comparative purposes. For cooks 448 to 451 the aspen chips were screened very carefully and the resultant pulp was therefore exceptionally clean. For cooks 475 to 478 this was not done, and the sheets from these cooks can better be compared with those from the impregnation cooks for cleanliness.

Before going further it will probably be well to explain certain column headings which are possibly ambiguous. In Table I, yields of crude pulp, screenings and screened pulp are based upon the bone-dry weight of the wood; yield per cord upon the assumption that the ordinary piled cord of rossed wood 4 by 4 by 8 feet contains 100 cubic feet of solid wood. The weight per cubic foot for spruce was taken as 24 pounds and of aspen 23 pounds.

In Table II the percentage impregnation was estimated from the gallons of acid driven into the chips and the bone-dry weight of the wood. The strength tests, with the exception of the tearing test, are all well known. The tearing test was made using a machine developed at the laboratory, and which is considered reliable. For comparative purposes it might be said that a sheet which will test 1 pound tear per pound weight is very satisfactory.

The aspen cooks were made with the purpose of reducing time and obtaining an easy bleaching stock. While time was reduced and a high yield of good pulp obtained, in no case did the bleach consumption approach that of the longer cooks. In general, and under normal conditions, bleach consumption will

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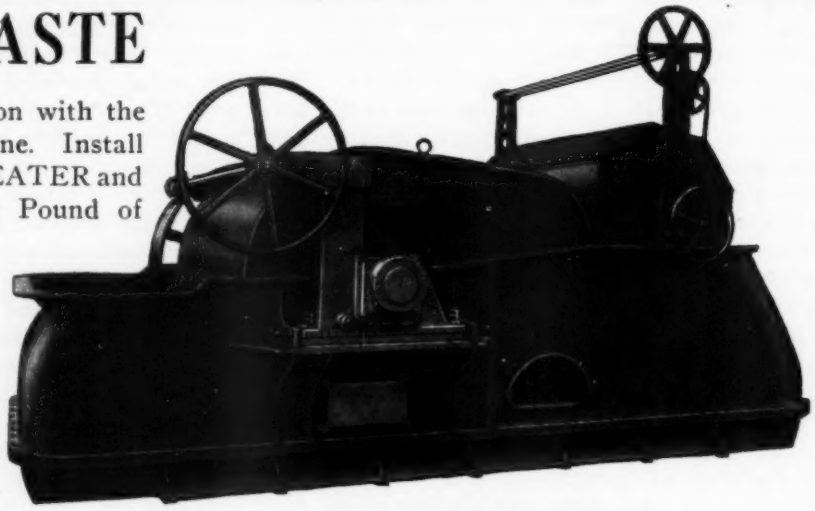

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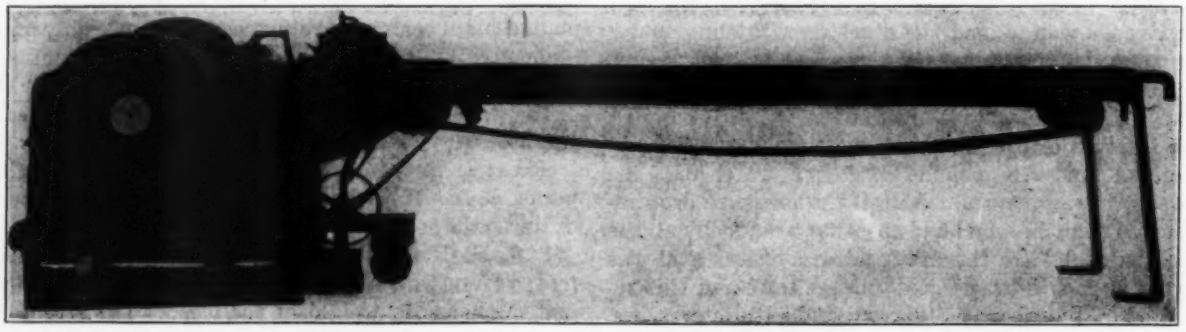

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TABLE I.—COOKING DATA ON ASPEN AND WHITE SPRUCE PULPED WITH AND WITHOUT PRELIMINARY IMPREGNATION

Cook No.	Species	Lbs. chips B. D.	Water in chips	Acid	Cooking liquor per 100 lbs. wood	Vacuum	Length of vacuum	Pressure	Impregnation Time	Impregnation Temp.	Impregnation Kind	Impregnation Amount	Time to 100 °C.	Maximum temp.
		Lbs.	Gal.	Gal.	Gal.	in.	Min.	Lbs.	Min.	°C.		Gal.	Hrs.	°C.
448	Aspen	71.6	4.4	56	85.2	None	....	....	....	....	....	....	1.00	153
449	Aspen	67.2	4.2	54	86.7	None	....	....	....	....	....	....	1.00	154
450	Aspen	62.9	4.8	56	96.7	....	....	....	....	....	....	....	1.00	153
451	Aspen	65.05	4.9	53	89.0	....	....	....	....	....	....	....	1.00	153
453	Aspen	76.7	5.9	Dig. full	....	20	24	75	22	30	Hydraulic	11	.75	145
464	Aspen	89.4	4.1	61.7	73.7	26	30	75	Cont.	32	Air	4.5	.75	144
465	Aspen	64.8	1.8	57.0	90.7	25.50	20	75	Cont.	26	Air	4.0	.75	148
467	Aspen	67.9	2.4	61.6	94.3	None	....	75	Cont.	23	Air	11.5	.75	148
470	Aspen	66.6	3.1	56.0	88.7	None	....	75	Cont.	26	Air	8.7	.75	155
471	Aspen	2 inch blocks—all indications pointed to a satisfactory cook but upon blowing found interior soft but badly burned.												
473	Aspen	68.4	3.1	58.5	90.0	None	....	75	Cont.	25	Air	11.3	.75	148
475	Aspen	68.5	3.7	51.0	79.8	None	....	....	....	....	....	....	1.00	153
478	Aspen	66.4	3.5	35.0	87.3	None	....	....	....	....	....	....	1.00	148
452	White spruce	....	....	....	....	13	10	65	....	....	Hydraulic	....	.75	145
454	White spruce	....	....	....	....	20	25	75	15	31	Hydraulic	7.7	.75	149
455	White spruce	64.0	1.3	54	86.5	25.50	20	75	15	31	Hydraulic	4.5	1.00	152
458	White spruce	50.4	0.7	55	103.0	24.50	35		(8½ lbs. liquid SO_2 put in)				1.00	148
466	White spruce	67.9	1.5	61.6	90.8	26	40	75	Cont.	29	Air	2.5	.75	147
468	White spruce	75.4	1.5	56.2	77.6	None	....	50-75	Cont.	23	Air	5.8	.75	149
469	White spruce	64.80	1.2	57.3	99.2	None	....	75	Cont.	24	Air	8.0	.75	161
472	White spruce	70.05	1.2	56.2	81.9	None	....	66	Cont.	28	Air	7.5	.75	131
*474	White spruce	61.6	1.2	60.6	100.5	None	....	75	Cont.	29	Air	7.8	.75	149
476	White spruce	63.5	1.1	58.3	93.5	None	....	....	....	....	....	....	1.00	153

Cook No.	Species	Cooking time	Total time	Maximum pressure	Blow pressure	Gas pressure at blow	Acid Combustion Total SO_2	Acid Combustion Free SO_2	Acid Combustion Combined SO_2	Pulp yields Crude	Pulp yields Screenings	Pulp yields Screened	Per cord	Bleach consumption
		Hrs.	Hrs.	Lbs.	Lbs.	Lbs.	%	%	%	%	%	%	Lbs.	%
448	Aspen	8.00	8.00	100	70	10	5.49	4.32	1.17	49.0	0.2	48.8	1,120	5
449	Aspen	7.00	7.00	100	70	10	5.49	4.39	1.10	51.4	0.3	51.1	1,175	8
450	Aspen	7.00	7.00	100	70	10	4.15	3.00	1.15	53.3	0.6	52.7	1,210	8
451	Aspen	8.00	8.00	100	64	4	3.57	2.51	1.06	52.8	0.4	52.4	1,205	9
453	Aspen	3.00	4.10	100	60	15	5.04	4.00	1.04	51.0	0.8	50.2	1,155	38
464	Aspen	5.00	5.75	75	52	10	4.65	3.66	0.99	55.1	1.3	53.8	1,236	13
465	Aspen	4.25	5.25	75	53	1	4.40	3.47	0.93	53.5	1.3	52.2	1,200	17
467	Aspen	4.00	4.50	75	57	7	4.80	3.74	1.06	54.90	1.5	53.40	1,228	18
470	Aspen	4.50	4.50	78	62	0	4.40	3.42	0.98	52.59	0.99	51.60	1,187	21
471	Aspen	2 inch blocks—all indications pointed to a satisfactory cook but upon blowing found interior soft but badly burned.												
473	Aspen	5.00	5.00	78	54	3	4.72	3.68	1.04	55.0	1.5	53.5	1,230	18
475	Aspen	7.00	7.00	100	70	10	5.14	4.03	1.11	51.1	1.2	49.9	1,149	36
478	Aspen	7.00	7.00	75	55	4	4.54	3.44	1.10	53.5	0.8	52.7	1,213	12
452	White spruce	1.75	2.00	75	56	....	5.00	4.00	1.00	Very raw				....
454	White spruce	4.75	6.67	75	75	18	5.00	4.00	1.00	Spruce blocks—burned.				
455	White spruce	5.75	6.75	75	56	0	5.17	4.16	1.01	62.2	2.2	60.0	1,440	42
458	White spruce	5.50	7.25	75	51	6	3.56	2.32	1.24	60.4	8.0	52.4	1,257	42
466	White spruce	5.00	5.75	75	61	12	4.86	3.86	1.00	48.88	0.68	48.20	1,155	39
468	White spruce	5.25	5.25	75	51	0	5.00	3.99	1.01	52.43	5.23	47.2	1,130	36
469	White spruce	3.50	3.50	78	78	0	4.96	3.95	1.01	57.53	0.43	57.10	1,370	....
472	White spruce	11.00	11.00	75	40	14	5.46	4.56	0.90	49.2	0.4	48.8	1,170	20
†474	White spruce	5.50	5.50	77	55	3	5.16	4.16	1.00	54.8	3.3	51.5	1,235	36
476	White spruce	8.00	8.00	75	64	4	4.97	3.80	1.17	46.8	0.9	45.9	1,102	17

*Duplicate of 468.
†For cooks 464 to 474, inclusive, a pressure of 75 pounds was maintained from the start until three-fourths of an hour before blowing. See Figure II for curves.

vary inversely with the yield. This assumption does not hold true when comparing the standard and impregnation cooks, though among themselves the standard cooks agree very well.

No obvious reason appears for this peculiar behavior, but with such short cooking times it is possible that the acid composition is not the most satisfactory. This, however, has not been worked out.

Strength tests on aspen are not of great interest and in the case of cooks 465, 470 and 475 are affected to an appreciable extent by the heavier sheet tested.

The same color discrepancy held with the spruce pulps, but here strength, yield and screenings are of prime importance. This darkening of the sheet, however, would not be sufficiently serious to prevent use of the pulp in news or the darker colored wrappings. In order that the relative merits of papers from these cooks may be judged, Table III has been compiled. The cooks are arranged in order of screenings; yield of screened pulp is shown in the next column. Then follows the standing of each cook in the order of various strength tests. As an example:

Cook	Bursting strength Points per pound	Bursting strength Points per pound
474	1.050	1
466	0.922	2
472	0.877	3, etc.

Therefore, the cook which has the lowest number of total points should be the best. This particular grading assumes that each strength test is of equal value in determining the worth of a sheet. Also, certain differences in tests are so small as to be within the experiment error and, furthermore, the intervals between grades are not regular. In addition to strength rating the color rating has also been noted in the same manner. While this method of judging papers is open to criticism, it at least affords a means

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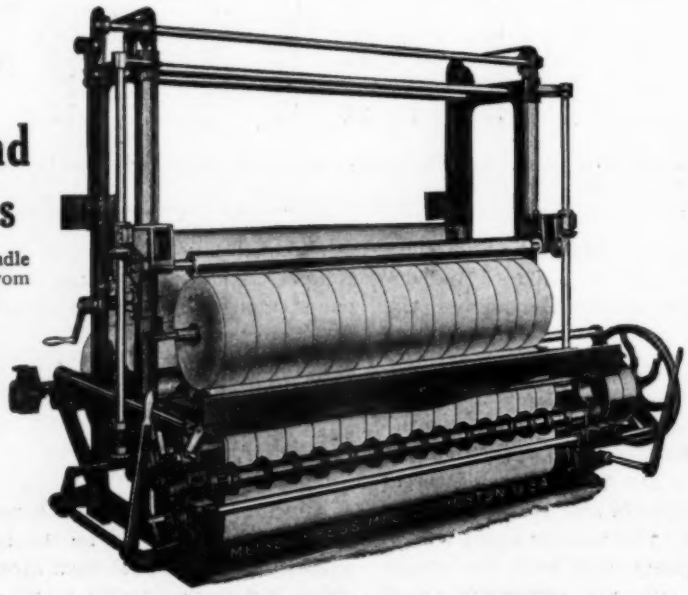

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TABLE II. STRENGTH AND CONDENSED COOKING DATA ON ASPEN AND WHITE SPRUCE PULPED WITH AND WITHOUT PRELIMINARY IMPREGNATION

COOKING DATA

Cook No.	Species	Method of pulping	Maximum temp.	Time	Acid composition: Total SO_2	Acid composition: Free SO_2	Acid composition: Combined SO_2	Yield screened pulp	Bleach consumption	Impregnation on B.D.
			°C	Hrs.	%	%	%	%	%	%
448	Aspen	Regular	153	8.00	5.49	4.32	1.17	48.8	5	None
449	Aspen	Regular	154	7.00	5.49	4.39	1.10	51.1	8	None
450	Aspen	Regular	153	7.00	4.15	3.00	1.15	52.7	8	None
451	Aspen	Regular	153	8.00	3.57	2.51	1.06	52.4	9	None
453	Aspen	Vac. & press.	145	3.00	5.04	4.00	1.04	50.2	over 38	120
464	Aspen	Vac. & press	144	5.00	4.65	3.66	0.99	53.8	13	42
465	Aspen	Vac. & press.	148	4.25	4.40	3.47	0.93	52.2	17	51
467	Aspen	Pressure only	148	4.00	4.80	3.74	1.06	53.4	18	135
470	Aspen	Pressure only	155	4.50	4.40	3.42	0.98	51 6	21	109
471	Aspen	Pressure only	2" blocks—burned interiors							
					4.75	3.60	1.15			
473	Aspen	Pressure only	148	5.00	4.72	3.68	1.04	53.5	18	137
475	Aspen	Regular	153	7.00	5.14	4.03	1.11	49.9	8	.....
478	Aspen	Regular	148	7.00	4.54	3.44	1.10	52.7	12	.....
452	White spruce	Vac. & press.	145	1.75	5.00	4.00	1.00	Very raw		
454	White spruce	Vac. & press.	149	4.75	5.00	4.00	1.00	Spruce blocks burned		
455	White spruce	Vac. & press.	152	5.75	5.14	4.16	1.01	60.0	over 42	58
458	White spruce	Vac. & press.	148	5.50	3.56	2.32	1.24	52.4	over 42	.....
466	White spruce	Vac. & press.	147	5.00	4.86	3.86	1.00	48.2	30	30
468	White spruce	Pressure only	149	5.25	5.00	3.99	1.01	47.2	over 36	64
469	White spruce	Pressure only	161	3.50	4.96	3.95	1.01	57.1	....	103
472	White spruce	Pressure only	131	11.00	5.48	4.56	0.90	48.8	20	89
474	White spruce	Pressure only	149	5.50	5.16	4.16	1.00	51.5	over 38	105
476	White spruce	Regular	153	8.00	4.97	3.80	1.17	45.9	17	.....

STRENGTH DATA

Cook No.	Ream weight	Average Mullen test	Thickness	Bursting strength per lb.	Bursting strength per .0001 inch	Average breaking length	Double folds	Average stretch	Average tear in .01 lb. per lb. weight	
	Lbs.	Lbs.	Inches			Meters		%		
448	74.6	20.7	.0061	.277	.344	3336	3.0	1.07	....	
449	67.9	21.0	.0055	.309	.379	3463	4.0	1.11	....	
450	79.2	23.7	.0063	.299	.376	3518	5.0	1.05	....	
451	67.9	25.7	.0054	.381	.479	4100	5.0	1.29	....	
453	79 0	27.2	.0067	.354	.406	3574	3.0	1.17	....	
464	87.8	31.8	.00705	.362	.451	3787	5.4	1.06	....	Pressure cont.
465	102.0	45.3	.00796	.445	.569	4187	19.0	1.28	....	Pressure cont.
467	95.3	44.4	.00800	.466	.554	4750	13.0	1.43	....	Pressure cont.
470	119.0	58.9	.0091	.495	.644	4194	45.0	1.54	....	Pressure cont.
471										
473	121.0	53.9	.0090	.445	.599	4285	20.0	1.49	....	Pressure cont.
475	110.0	38.8	.0082	.352	.475	3844	13.0	1.48	....	No impregnation
478	61.4	25.7	.0048	.418	.533	4097	9.0	1.31	....	No impregnation
452										
454										
455	46.0	36.2	.0033	.786	1.098	6800	698.0	1.48	.765	
458	40.5	28.9	.0029	.714	.994	6262	468.0	1.32	.795	Liquid SO_2 charged at end of vacuum
466	44.5	41.0	.00305	.922	1.350	8340	535.0	2.48	.952	Continuous pressure
468	41.5	35.2	.0029	.850	1.210	6685	415.0	2.21	.694	Continuous pressure
469	50.9	37.1	.0036	.630	1.030	6581	647.0	1.87	.776	Continuous pressure
472	58.6	51.4	.0039	.877	1.310	6833	997.0	2.94	.950	Continuous pressure
474	50.9	53.3	.0037	1.050	1.440	7652	818.0	2.07	.830	Continuous pressure
476	49.5	40.9	.00308	.853	1.335	6500	790.0	2.47	.975	No impregnation

of comparing various papers when the samples themselves are not available.

If the need for such a rating exists it would not be a difficult matter to adopt standards for various grades of paper in each case, so weighting the tests as to emphasize the desired qualities.

TABLE III.—GRADING OF PULPS BY STRENGTH TESTS

Cook	Screenings per cent	Yield per cent	Bursting str. Pts. lb.	Breaking length	Folds	Tear	Stretch	Total points	Strength rating	Color rating
458	8.0	52.4	7	8	7	5	8	35	8	8
468	5.2	47.2	5	5	8	8	4	30	6	5
474	3.3	51.5	1	2	2	4	5	14	3	3
455	2.2	60.0	6	4	4	7	7	28	5	7
476	0.9	45.9	4	7	3	1	3	18	4	1
466	0.7	48.2	2	1	6	2	2	13	2	4
469	0.43	57.1	8	6	5	6	6	31	7	6
472	0.4	48.8	3	3	1	3	1	11	1	2

According to this method of rating cooks 472, 466, 474 and 476 are graded in the order named. No. 472 approached a Mitscherlich cook in method of treatment and quality of pulp; Nos. 466 and 474 were made by the modified method, while No. 476 was a standard laboratory cook. Thus it is seen that forced impregnation, shorter time and lower temperature produce a pulp more nearly approaching that made by the slow cook process than the regular laboratory quick cook.

In considering the adaptation of this suggested method of pulping to plant practice, it is well to direct attention to some of the factors which will have much to do with its ultimate success.

Various species offer quite different resistances to impregnation and as an example are shown two graphs by which the absorption of creosote by white spruce and aspen can be compared. It will be noted that aspen absorption is somewhat erratic, very probably due to difference in samples. However, when chipped the wood is so shattered that complete penetration would doubtless be obtained for all woods, although the amount of liquor absorbed would vary with each species.

Investigations into the effect of temperature upon

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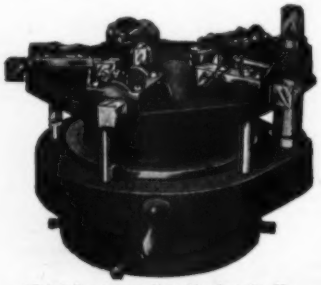

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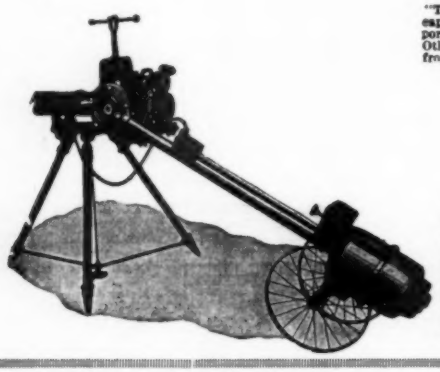

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both the rate of impregnation and penetrance of wood preservatives have very clearly indicated that, owing entirely to decreased viscosities, increased temperatures have resulted in increased impregnation. Within certain lower limits of viscosities, comparable with water, the increase in penetrance for very small decreases in viscosities is extremely rapid.

If this relationship holds, the use of hot acid would materially increase the rate of penetration aside from savings in other directions. However, unless some arrangement can be made to hold the gas in the acid it will probably be impossible to use a temperature much over 38° Cent. atmospheric pressure, and this most mills are now doing. However, the pressures

TABLE V.—COOKING DATA ON ASPEN AND WHITE SPRUCE PULPED WITH AND WITHOUT PRELIMINARY IMPREGNATION

COOKING DATA

No. Cook	Species	Method of pulping	Maximum temp. °C	Time Hrs.	Acid composition: Total SO_2 %	Acid composition: Free SO_2 %	Acid composition: Combined SO_2 %	Yield screened pulp %	Bleach consumption %	Impregnation on B.D. %
469	White spruce	Pressure only	161	3.50	4.96	3.95	1.01	57.1	.....	103
516	White spruce	Pressure only	159.5	4.50	4.73	3.60	1.13	54.3	over 48	106
519	White spruce	Pressure only	158	5.50	5.05	4.78	1.27	52.3	33	96
468	White spruce	Pressure only	149	5.25	5.00	3.99	1.01	47.2	over 36	64
474	White spruce	Pressure only	149	5.50	5.16	4.16	1.00	51.5	over 36	105
515	White spruce	Pressure only	148	5.50	4.81	3.61	1.20	55.2	over 48	104
517	White spruce	Pressure only	148	5.50	4.83	3.44	1.39	57.8	over 48	126
473	Aspen	Pressure only	148	5.00	4.72	3.68	1.04	53.5	18	137
505	Aspen	Pressure only	148	5.25	4.70	3.61	1.09	53.8	26	135

STRENGTH DATA

Cook No.	Ream weight Lbs.	Average Mullen test Lbs.	Thickness Inches	Bursting strength per lb.	Bursting strength per .0001 inch	Average breaking length Meters	Double folds	Average stretch %	Average tear in .01 lb. per lb. weight	
469	50.9	37.1	.0036	.630	1.030	6581	647.0	1.87	.776	Continuous pressure
516	50.0	44.5	....	.888	1.129	8031	307.0	1.93	....	Continuous pressure
519	51.4	46.7	....	.909	1.191	7431	668.0	2.09	....	Continuous pressure
468	41.5	35.2	.0029	.859	1.210	6685	415.0	2.21	.694	Continuous pressure
474	50.9	53.3	.0037	1.050	1.440	7652	818.0	2.07	.830	Continuous pressure
515	54.7	52.3	....	.956	1.139	7761	224.0	1.36	....	Continuous pressure
517	49.1	51.6	....	1.052	1.337	7988	317.0	1.74	....	Continuous pressure
473	121.0	53.9	.0090	.445	.599	4285	20.0	1.49	....	Continuous pressure
505	68.9	38.0	....	.551	.662	5090	5.8	1.52	....	Continuous pressure

Ordinarily one does not think of the viscosity of water changing appreciably with temperature, but a glance at the following compilation taken from the Smithsonian Physical Tables shows that such is the case.

Although no authority exists for substituting water viscosities in the curve equation as derived from creosote, it is almost certain that the changes will be of the same order.

With that end in view, using the curve equation—

$xy = 0.3$,

where, — x = the longitudinal penetration in inches and

y = the absolute viscosity in dynes per square centimeter; solving for x we have in the following table:

TABLE IV.—VISCOSITY AND CALCULATED PENETRATION OF WATER AS AFFECTED BY TEMPERATURE

Temperature Degrees Cent.	Absolute viscosity dynes per sq. cm.	Calculated penetration inches
0	0.0179	16¾
25	0.0083	36¼
50	0.0055	54½
75	0.0038	79
100	0.0028	107

developed by sulphurous acid solutions at increased temperatures are not high and it should therefore be a comparatively simple matter to construct an intermediate charging tank between the acid storage tanks and the digesters, where the hot acid could be kept under moderate pressures. As previously mentioned, the possibilities opened up by the use of hot charging acid are very interesting and it is unfortunate that equipment is not available for investigation of this phase of pulping. More important than the rapid impregnation would be the really enormous savings in steam consumption and the elimination of relief gas coolers.

If cooking is to be carried on more rapidly, greater acid, steam, relief tower and wet room capacity must be provided. While none of these need be considered in experimental operations, each becomes of importance when plant equipment is used.

The possibility of shortening very materially the preliminary treatment of Mitscherlich cooks is apparent and the resulting saving in time would be of even greater benefit than in the quick cook process. In any case the percentage shortening of time would be greater than the laboratory cooks indicated because of the longer time generally required in plant operations to come up to pressure. There would also be

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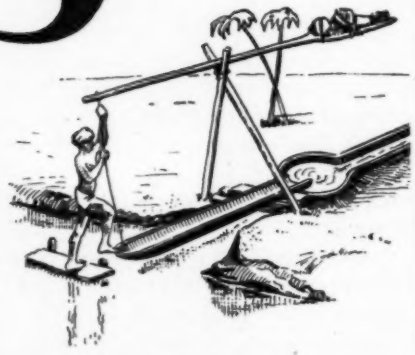

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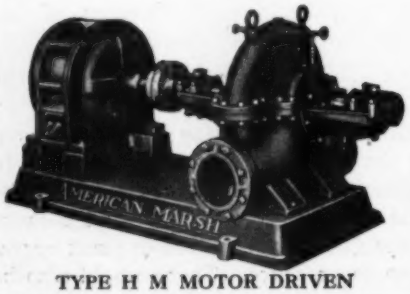

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some saving in steam, but this feature is probably not of great importance. In the pulping of sawmill refuse, where the chip lengths are quite variable, the use of preliminary impregnation should be the means of eliminating the trouble which is usually experienced when pulping this type of material, either alone or mixed in with regular chips.

While these experimental cooks are very promising, it still remains for a mill scale trial to be made under such conditions as will demonstrate the value of the modified method. This, we hope, will be accomplished in the near future.

Conclusions

These few experimental cooks have served to demonstrate that woods can be pulped successfully in appreciably shorter times and at lower temperatures by the use of preliminary impregnation. Both yield and pulp quality have been improved, though color and ease of bleaching are not entirely satisfactory.

Supplementary Report

In the original report upon this modification of the regular sulphite pulping method it was pointed out that very possibly the difficulty experienced in obtaining a white colored and easy bleaching stock might be due to lack of sufficient lime in the cooking acid. Furthermore, it was discovered that the testing chemicals used in the first series of cooks had been incorrectly standardized and that the amount of lime present was lower than supposed. Accordingly, a series of five spruce cooks and one aspen cook were made using a higher combined, conditions of time and temperature remaining practically the same as in the former runs. For purposes of rendering comparison easy the data on these cooks, which were duplicated from the previous report, are included in Table V.

White Spruce

Cooks Nos. 469, 516 and 519 can probably be compared, the most important variable being time, although temperature and acid composition were not quite the same. The most striking difference lies in the brighter color shown by cooks Nos. 516 and 519, the latter being the brightest of the series. It is possible, of course, that this difference may be caused by either the increased time or the higher combined, but in any case the advantage over pulp from No. 469 is very marked. The differences in yield are not any more than would be expected under the changed cooking conditions, though the screenings in No. 469 appear quite low. This is doubtless because the pulp was run through the shredder before being put over the screen, which procedure was not followed in the case of Nos. 516 and 519. In average strength, the sheets grade in about the following order: 519, 516 and 469. The fold, however, on the latter pulp is comparatively high, although the pop test and breaking length are much lower than the others. In general appearance and feel paper from cooks Nos. 516 and 519 are far superior. It was found practically impossible to bleach pulp from Nos. 469 and 516, but that from No. 519 gave a satisfactory color at 33 per cent, which, however, is quite high. It is very interesting to note that pulp from No. 519 was brighter in color than either cooks Nos. 472 and 476 covered in the previous report. In fact, the pulp obtained from No. 519 is unsurpassed by any produced in this study.

Duplicates were next made of cooks Nos. 468 and 474, in order to determine the effect of the varying combined upon the pulp. These cooks are numbered Nos. 515 and 517. The most striking difference is that of color, and beyond a doubt the larger amount of lime in the cooking acid is responsible. Further, the yield of screened pulp is much higher when the higher combined is used and the amount of screenings lower. None of the pulps, however, are easily bleached. In general, the pulps produced, using a higher lime, are superior in strength to those in which the smaller amount of lime was used, although both Nos. 468 and 474 are superior on folding tests, cook No. 515 being the poorest of the series.

Aspen

Cook No. 505 was made duplicating No. 473, using a trifle higher combined. The results, however, do not indicate that any advantage was gained in this particular instance by the use of increased combined, but it was noted that the pulp deteriorated in color very decidedly over night. In view of the results obtained on spruce, it is felt that further work should be done along this line.

Conclusions

It is very evident from these experiments that in using the modified method of pulping it is necessary to change the acid composition to take care of the increased speed of the chemical reaction. The purpose of the lime in sulphate acid is to remove from the sphere of reaction the decomposition products formed by reaction of a sulphite acid and the lignin complexes. Evidently, when these complexes are formed more rapidly than usual, it is necessary to have higher concentrations of lime present in the solution. Increased yields, decreased screenings and stronger pulp also accompany the use of higher combined, and any objection which may have existed to the use of this modified method is now removed. It remains, however, for a mill scale trial to demonstrate finally the feasibility of the idea.

Clogging of Grates

In hand-firing and many forms of mechanical stokers, faulty operation is due to air spaces in the grates being clogged. A systematic method should be used to overcome this difficulty by keeping the air spaces clean.

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Electrical Hazards

By FRED M. ROSSELAND
Safety Engineer, National Safety Council

THE increased use of electricity in all industries and the number of appliances adapted to almost every kind of work has introduced a new hazard which workers are inclined to overlook. In addition, the inquisitive, mischievous or careless employe finds in electricity a new toy or weapon with which to play —invariably placing himself or others in danger of serious or even fatal injury.

Wiring Outside of Building

If electricity is not manufactured at the plant it is brought to it usually by overhead wires. Frequently it is brought in at high voltages, which must be transformed or stepped down to the lower commercial voltage of the motors used in the plant. The transforming equipment and the wires leading to and from it are usually isolated and guarded, but boys and sometimes older employes who are inquisitive or mischievous may attempt to "monkey" with it. Such practices should be prohibited and the foreman should not only give personal instructions but should give close supervision—in so far as is practicable—to see to it that all employes under his direction keep hands off. Workers should be instructed to consider all such wires and equipment as being "alive" and to report promptly any breaks in the wires or signs of unusual conditions in the equipment.

Even though the voltage of the wires be only 110 volts (commonly used for household lighting) employes should be taught to respect it and to keep away from it. Conditions may exist of which the worker is unaware which make this voltage dangerous, and even telegraph and telephone wires carrying still lower voltage carry sufficient electricity for a fatal shock.

Lighting Circuit

The lighting circuit of the plant, both indoors and outdoors, may be safely handled only by the plant electrician, and the amateur electrician among the workers should be prohibited from repairing or experimenting with the lighting system. If the line has broken down or if the switch is out of order the electrician should be called upon to make repairs. Even the replacing of burned out incandescent lamps carries an element of hazard if it is attempted while the current is "on"; if it is absolutely necessary for the worker to do this he should be instructed to shield his face with his arm or hand or turn it away while screwing in the lamp. Practices such as lighting cigarets in the arc formed when the contact points of a switch are almost closed are dangerous, the danger being from shocks, from burns or from the flash in the eyes of the worker.

Power Circuits

Frequently motors are operated on circuits of a higher voltage than that of the lighting system, and this is still more dangerous for the meddlesome worker or amateur electrician. Workers should be prohibited from attempting to repair motors, wires, switches or any other part of the electric equipment. Explicit instructions should be given that any and all repairs may be made only by the electrician, and if any repairs are necessary they should immediately be reported to the foreman.

Switch Boxes—Fuse Boxes

Switch boxes and fuse boxes should be kept locked, preferably, but if this is impractical or undesirable for any reason, specific instructions should be given to workers prohibiting them from placing tools or metal parts of metal cans (for example, oil or varnish cans) in the switch box or fuse box, and regular inspections should be made to see that this rule is observed. The danger here is that the metallic articles will cause a short circuit and either injure the employe by the flashover or damage the equipment.

The efforts of ambitious workers to replace a burned out fuse by means of copper pennies or other metallic substance, copper wire, etc., should be prohibited; not only is there danger of shock to the employes, but when the protection of the fuse is removed the equipment may be seriously damaged in case of overload or short circuit.

Electrical Fires

All workers should be warned not to attempt to put out an electrical fire by the use of water or soda acid extinguishers, or any type of extinguisher which includes water. The water is an electrical conductor and may be the means of a serious electrical shock. All such fire extinguishers should be removed from the vicinity of electrical apparatus, if practicable, and replaced by extinguishers of the carbon tetrachloride type. Various types of dry powder extinguishers and dry sand may also be used to extinguish electrical fires.

Explosive or Imflammable Material

The use of electricity in locations where explosive, inflammable gases or flying bits of inflammable material are found is decidedly dangerous, for a spark or the arcing of a switch or motor may ignite the explosives or the inflammable material. Workers should be warned to avoid this condition at all times.

Direct Ground

Where employes work on cement floors, on wet wooden floors or on the ground it is important that

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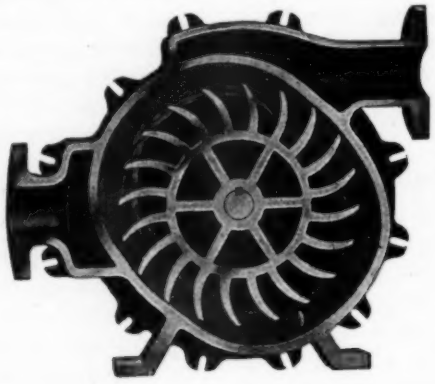

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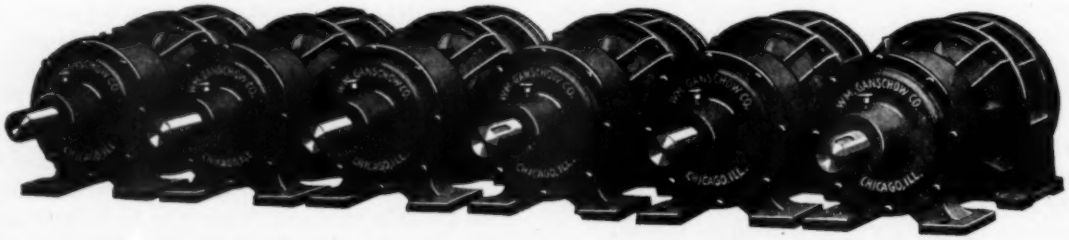

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they be provided with rubber mats or insulating stools to stand on while operating switches, or where it is possible to come into contact with the electrical conductors. In such places warning signs should also be installed—especially if the places are infrequently visited.

Connectors

Employes should be warned to observe closely the insulation (covering of electrical drop cords, connectors, or transfer cables) because they are likely to become unsafe if the insulation is damaged—by abrasion, ordinary wear or deterioration.

General

Two types of injuries are caused by electric currents: (1) electric shocks, and (2) electric burns. In electric shocks the body becomes a part of the current and the current passes through the body without visible burning or with a mere puncture burn. In electric burns the body comes too close to an electric arc. Some electrical burns are the result of the heat generated by the current. Other burns which arise from arcing and electric welding (of which "flashed eyes" is a type) are due to the injurious rays of the arc, the injured person being too far away to experience heat burns.

The exact quantity of electric current that may pass through the human body without danger to life has not been determined. It is well known that one-tenth of an ampere may be dangerous and that one-fourth of an ampere may prove fatal, although from 7 to 10 amperes are used during the electrocution of criminals. From the accident prevention standpoint, at least, the only safe procedure is to "let it alone."

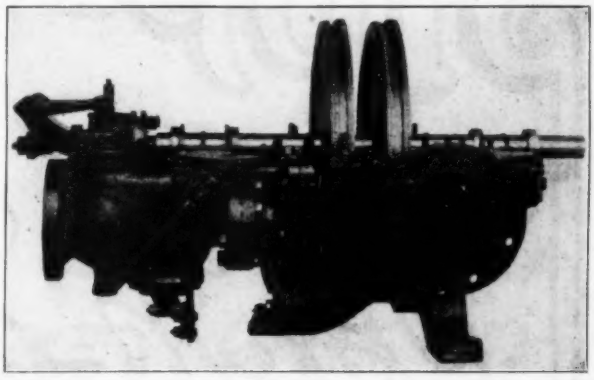
Foremen must guard against that familiarity with electricity which breeds contempt. Foremen should see to it that the electrical safety equipment and the safeguards installed in their departments are maintained and workers should be instructed that, regardless of their own past experience with electricity, the rules of the company governing the use of electricity must be obeyed and the instructions concerning defective electrical equipment or apparatus must be followed.

Wherever practicable it is recommended by the National Safety Council that foremen encourage their workers to learn the prone pressure method of resuscitation and also that, once having learned the method, the workers be encouraged to practice it regularly.

A New Turbine

A NEW turbine, of the Curtis type suitable for driving such apparatus as centrifugal pumps for waterfilters, stock and water pumps, defibering and de-inking machines, etc., has recently been developed by the General Electric Company. The turbines are of one, two or three stages, and operate at steam pressures of from 50 to 300 lbs., with or without superheat, and either condensing or non-condensing.

The turbine is constructed throughout so as to give the greatest strength and rigidity possible and the casing is divided horizontally in two halves, the upper of which can be easily raised for inspection or removal of the wheels. The steam connections are so arranged that they need not be disturbed when it is desired to remove the top of the casing.



The turbine is equipped with speed control in the form of a centrifugal governor, and, if desired, an emergency governor. The first is of the centrifugal tension spring type, the motion of the weights being transmitted through ball bearing connections to the governor valve. The speed may be adjusted while the turbine is running by a simple operation of the governor valve. The emergency governor, if attached, operates entirely independently of the main governor, when the speed rises to about 15% above normal.

The steam passes through the first stage nozzles, from the steam chest, the nozzles being opened, or closed, as required by hand valves placed in the steam chest. The governors control the flow of steam to all nozzles.

A New Type of Stuff Pump

A STEP in advance in paper making has been made in placing a new paper stock pump on the market that eliminates all of the objections and troubles that have been experienced in the past by the use of reciprocating plunger pumps and other types caused by valves sticking up, leaking packing, gear trouble, belt trouble, lubrication, and other causes and expense.

The Gregg stuff pump is a vertical rotary type of pump and does not contain any valves, or contracted passages, or chambers for the stock to lodge in and is absolutely reliable and dependable in every way and is claimed to be superior to other types of stock pumps heretofore used by the paper trade.

The design, construction and operation of this pump is as follows: A heavy vertical column pipe

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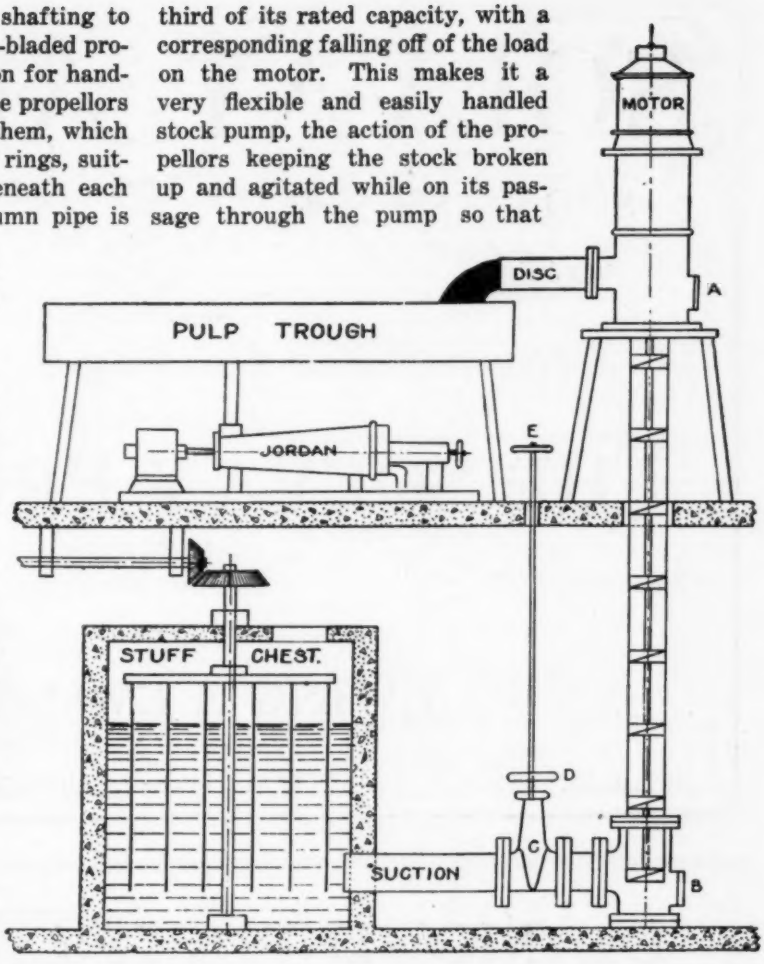
carries and supports a line of vertical shafting to which are attached at fixed intervals two-bladed propellors of suitable design and construction for handling any and all kinds of paper stock. The propellors have heavy bands or rims surrounding them, which in turn operate inside of steel or bronze rings, suitable retarding blades being provided beneath each propellor. The lower end of the column pipe is secured to a heavy base fitting and the top end extended up through the floor so as to connect to the base plate of the power head.

The power head, which is set at any desired elevation so as to discharge the stock at the desired point, is provided with a heavy duty roller bearing which carries the weight of the shafting, the propellors and the weight of the stock that is handled.

The power head is provided with a vertical motor of proper size and speed for operating the pump to its capacity.

The base of the pump, which can set on the basement floor line, is connected to the bottom of the stuff chest by a suction line of suitable size and arranzement, a gate or three-way valve being placed in the suction line between the pump base an dthe stuff chest.

The accompanying cut shows the general arrangement of this pump and its connections and operation, but different combinations and arrangements can be made so as to apply its use to any plant, regardless of the locations of the stuff chests, Jordans or beating engines.



In operation the gate valve "C" is opened and the vertical motor started and the pump brought up to speed. The paper stock from the stuff chest is immediately drawn through the suction line by the propellor pump fittings and raised up and discharged into the pulp trough or other receptacle.

If the amount of stock discharged is greater than required the gate valve "C" can be partly closed by use of the hand wheels "D" or "E" so that just enough stock is raised as is required. This pump can be choked down so as to deliver less than one-third of its rated capacity, with a corresponding falling off of the load on the motor. This makes it a very flexible and easily handled stock pump, the action of the propellors keeping the stock broken up and agitated while on its passage through the pump so that heavy stock, or stock with pieces of metal, rope or sticks in same can be handled with safety and impunity.

Should it be necessary to clean or drain this pump in changing colors, or for other reasons, the pump and motor are stopped, the handhole plates "A" and "B" removed, a hose turned in opening "A," which is 10 inches by 12 inches, and the stock washed down and out through the opening "B" and into the sewer. The pump can be stopped, opened up, thoroughly washed out and closed up and started again within 30 minutes.

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National Forestry Committee Program

THE Snell forestry bill has been reintroduced in Congress and is now known as H. R. 129, having been introduced on the first day of the sixty-seventh Congress. The bill is in all essentials the same as the measure in the last Congress. Letters from Washington indicate that there will be early hearings upon the measure, and that Congressman Snell is determined to secure early consideration of its provisions. The total appropriations for acquisition of land for national forests is retained at $50,000,000 but made available as recommended by the National Forest Reservation Commission, composed of members of the Cabinet and Congress. There has been introduced a bill by Senator Smoot (S-490) providing for general land exchanges as provided in the letter sections of the Snell bill.

Meanwhile Senator Capper has announced that the revised Capper forestry bill, formulated to conform to the ideas of Mr. Pinchot for federal control of private forest operations, is being prepared and will be introduced in the upper house very soon.

Recent conventions brought out notable discussions of the Snell bill by various associations. W. L. Hall appeared in Chicago before the National Wholesale Lumber Dealers Association in its advocacy, and the National Lumber Manufacturers also discussed the campaign at the Chicago lumber congress.

One of the strongest appeals for a national forestry policy was that of the Calder committee report on housing, in which the need for a maintained timber supply was forcibly brought out.

The Chamber of Commerce of the United States, instructed to formulate a national forestry policy referendum, has begun its work.

The President's proclamation of a Forest Conservation Week, beginning May 22, gives executive approval to the campaign for a national appreciation of the need for forest protection. This committee will endeavor to be of service in assisting local organizations to secure material for use in this week's campaign of education.

Every person and organization interested in forestry should take this opportunity to help spread the gospel of this great movement.

One of the most important endorsements received is that of the New York City Federation of Women's Clubs, through unanimous vote of its board of directors upon the recommendation of the conservation committee headed by Mrs. Charles Cyrus Marshall. Notably effective work has been done in New York by Mrs. Marshall's committee. Last fall Mrs. Marshall asked for a forestry discussion by a speaker from the State College of Forestry, and after the National Forestry Program Committee was formed, arranged for several discussions before various groups of women interested in the future of our forests. The interest of the City Federation in the forestry program has been one of the most notable accomplishments of the Conservation Committee.

The campaign for legislation in Ohio has been pressed energetically. Philip W. Ayres of this committee, representing the Boston Chamber of Commerce and the Society for Protection New Hampshire Forests, addressed the Ohio legislature on the need for forest legislation in that state, and with State Forester Edmund Secrest, who arranged the trip, spoke also to the Directors of the Cincinnati Chamber of Commerce. The Ohio bill is framed to dovetail with the Snell bill for federal cooperation.

In the West, Col. Greeley has been discussing forest problems, and addressed a meeting of the California White and Sugar Pine Manufacturers which declared in favor of the Snell bill.

Wisconsin's campaign is progressing energetically, and the constitutional amendment for state forests has been passed. It now goes to public referendum. Bills for municipal forests have passed, and the proposal for increase of fish and game license fees to finance forestry work seems sure of passage, as the sportsmen themselves are behind it.

The campaign for general forestry and park development in Illinois has been followed up by the introduction of a state park measure, with an initial appropriation of $500,000 for the purchase of proper areas, and their development.

The fight against forest fires has been carried at Asheville, N. C., to the letter mail, the postoffice cancellation stamp now carrying the inscription, "Help Prevent Fire in the Mountains."

The Northern Chautauqua Fish and Game Club has passed resolutions endorsing the Snell bill, and the research department of the National Association of Credit Men has declared in favor of the bill, with the result that the Association will join in the campaign for the measure.

The legislatures are beginning to close up their work, and some notable advances in forestry legislation are to be noted, such as the passage of a taxation law in Indiana to promote forest growing. Even where the legislation failed of passage, there was evidenced an increasing interest and recognition of state needs, which will mean eventual success. State Forester, W. J. Morrill in Colorado, for instance, introduced a forest code to articulate Colorado laws with the Snell bill program, but the legislature adjourned early, and no action was issued. Next time Mr. Morrill anticipates success.

News Miscellany

Superintendent's Convention

The annual convention of the American Pulp and Paper Mill Superintendents' Association, which will be held at the Waldorf-Astoria Hotel, in New York City, on June 3, 4 and 5, is expected to draw the largest number which ever before attended one of these meetings.

The opening session will be held on the morning of Friday, June 3, and the first two days will be given over to the reading of papers and the regular transaction of business.

The following program has been outlined:

Friday Morning

"The Paper Machine," by Stuart D. Lansing.
"The Suction Roll," by William Millspaugh.
"Pulp and Paper Screens," by Phillips Dennett.
There will be a buffet luncheon at noon.

Friday Afternoon

"Paper Mill Preparation," by Nelson R. Davis.
"Dyestuffs Used in Paper Making," by Kenneth W. King.
"Beating," by C. C. Stewart.
"Manufacture of Coated Papers," by W. T. Schenk.
There will be a dinner and entertainment on Friday evening.

Saturday Morning

The morning session of Saturday, June 4, will open with a talk by Robert B. Wolf, foremost exponent of scientific management in the paper manufacturing industry. Mr. Wolf will be followed by Dr. Hugh P. Baker, who will read a paper on "Raw Materials."

"Investigation of Pulp Making Processes" will be read by Sydney D. Wells.

There will be a buffet luncheon at noon.

Saturday Afternoon

There will be two meetings in the afternoon—the Chemical Pulp Meeting and the Board Meeting.

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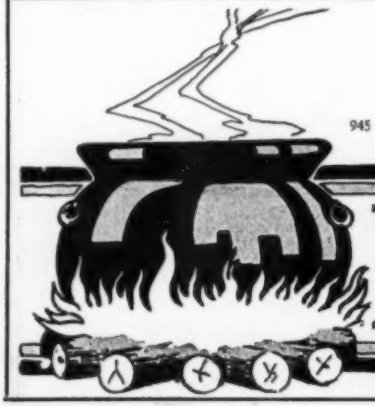

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The following papers will be read at the Chemical Pulp Meeting:

"Causticizing Problems in a Sulphate Mill," by Norman D. Brokaw.

"Cooking of Sulphite Pulp," by Benjamin T. Larrabee.

"Bleaching of Sulphite Pulp," by B. N. Petrie.

"Sulphate Soda Digesters," by H. LeRoy Whitney.

"Manufacture of Sulphate Pulp in Europe," by O. L. Berger.

"Board Mill Preparations," by John Hercher.

"Manufacture of Box Board," by L. T. Murphy.

There will be a banquet in the evening.

Sunday

Sunday, June 5, will be devoted to pleasure, and the superintendents will be in the hands of an active committee of New York folks who plan to show the superintendents the time of their lives.

Executive Committee of T. A. P. P. I. Holds Meeting

The first meeting held by the executive committee of the Technical Association of the Pulp and Paper Industry, since the election of George E. Williamson as president, took place at the Strathmore Inn, Woronoco, Mass., on Thursday, May 5, and lasted over Friday. There was a full attendance of members, and former president Raymond S. Hatch was also there to assist the new president. Mr. Williamson is chief engineer of the Strathmore Paper Company, which has mills at Woronoco as well as at Mittineague. The Strathmore Inn is maintained by the company for the comfort of executives and heads of departments, and a wing of the building was set aside for the use of the executive committee of T. A. P. P. I. for the duration of their meeting.

Much Constructive Work Transacted

It is safe to say that at no previous meeting of the executive committee of T. A. P. P. I. has so much work of a consturctive character been transacted. Plans of a Service Committee for the conduct of group meetings of the association were adopted and arrangements made for the fall meeting of the association to be held under the joint direction of T. A. P. P. I. and the American Pulp and Paper Mill Superintendents' Association at Washington, D. C., York and York Haven, Pa., and Philadelphia, October 18, 19 and 20, 1921. Fred A. Curtis, Paper Section, U. S. Bureau of Standards, Washington, was named general manager of the meeting for T. A. P. P. I. and he will be assisted by Grellet N. Collins, Philadelphia, and others. Owing to an expected attendance of upwards of 500 members and an already extended program of mill visitations, etc., it was found necessary to curtail the entertainment features to some extent. It was arranged that trips to York, York Haven and Wilmington be made optional for Wednesday, October 19. This curtails the session in Washington to one day, Tuesday, October 18, but members could arrange to reach Washington on Monday, October 17, and spend the day in seeing the sights of the Capitol.

New Standing Committees Named

Other business transacted by the executive committee included the appointment of standing committees of the association for the ensuing year, the adoption of a budget and passing on estimates of income and expenditures. Action was taken on a request by the Coast Association of the Paper Industry for an investigation of depreciation in values of machinery and apparatus, a special committee of the association to be named for the purpose.

Election of Members

New members of the Technical Association of the Pulp and Paper Industry have been admitted by the executive committee during and since the annual meeting as follows:

Charles L. Cockroft, night foreman, Everett Pulp & Paper Company, Lowell, Wash., manager.

Richard H. DeMott, manager industrial development department, SKF Industries, 165 Broadway, New York, N. Y.

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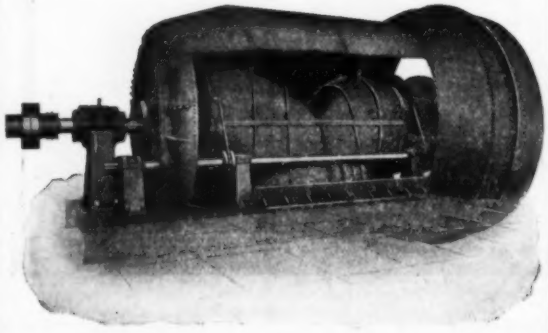

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Robert S. Finney, secretary and general manager, McNamee Kaolin Company, 60 Broadway, New York, N. Y.

Charles L. Harpham, manager of manufacturing, F. C. Huyck & Sons, Albany, N. Y.

Harry M. Hooker, sales manager, Hooker Electrochemical Company, 25 Pine Street, New York, N. Y.

Benjamin K. Hotchkiss, sales department, Hooker Electrochemical Company, 25 Pine Street, New York, N. Y.

Harold G. Ingraham, construction engineer, Marathon Paper Mills Company, Rothschild, Wis.

Dr. Edwin A. Rees, chemist, F. C. Huyck & Sons, Albany, N. Y.

John O. Ross, president and general manager, J. O. Ross Engineering Corporation, 30 East Forty-second Street, New York, N. Y.

Mammoth Work on Cellulose

Clarence J. West, chairman of the Committee on Bibliography, T. A. P. P. I., is just in receipt of the announcement of Technology of Cellulose Esters by E. C. Worden, the author of Nitrocellulose Industry. The sub-title shows the ambitious nature of this work: "A theoretical and practical treatise on the origin, history, chemistry, manufacture, technical application, and analysis of the products of acylation, and alkylation or normal and modified cellulose, including nitro-cellulose, celluloid, pyroxylin, collodion, celloidin, guncotton, acetylcellulose and viscose, as applied to technology, pharmacy, microscopy, medicine, photography and the warlike and peaceful arts." It is further seen in the fact that the book (or rather series of books) is to be issued in ten volumes, and that Volume I is issued in five parts, making a total of 3,087 pages in the first volume.

The announcement states: "The aim of this great work is to present the entire subject of the combinations of normal and modified cellulose with acidyl and alkyl radicals with absolute completeness, clarity and accuracy. It is the result of twenty-five years of patient research into all the ramifications of the fundamental subject of cellulose, which enters into so many vital industries of the present day. Significant matter from every available source has been accumulated and recorded in a permanent and readily available form.

"The subject has been approached from the standpoint of concrete analysis, logical deduction and historical continuity in development. In order to give greater clearness, matter not considered strictly relevant, as well as the more abtruse data for advanced thinkers, has been printed in smaller type to distinguish it from the regular textual matter.

"Every effort has been made to make the matter as brief and simple as is consistent with the intricacy of the subject, and therefore additional information for those particularly interested in a special topic has been placed in footnotes.

"Such basic materials as cellulose, starch, cotton, nitric and sulphuric acids, forming the subject matter of Parts I and II of Vol. I, have been treated in greater detail than has ever been attempted before in any language."

The principal contents of Volume I are:

I. The raw materials of cellulose and its modifications; starch and similar carbohydrates; cotton as being the cellulose more often esterfied; the preparation of cotton for the esterfying process.

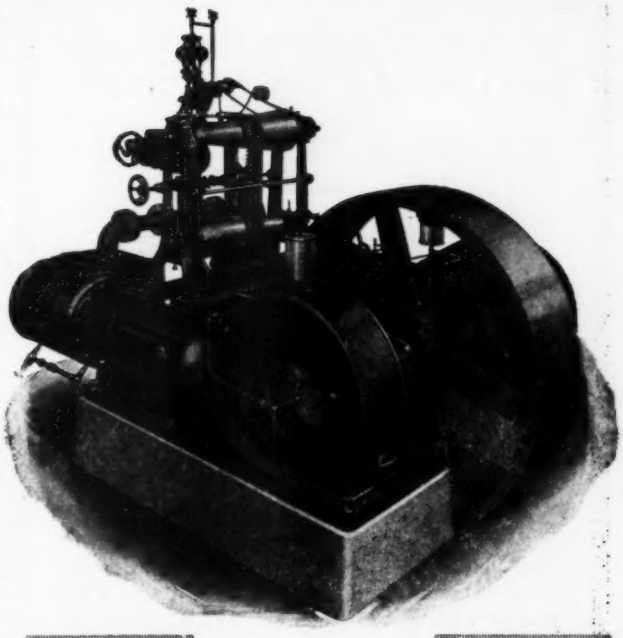
II. The manufacture of nitric and sulphuric acids; waste acids; tables, etc.

III. History and theory of the cellulose nitrates and nitrated carbohydrates, physical and chemical properties and ballistics; manufacture of cellulose esters; analytical examination of nitrated carbohydrates.

IV. Synoptical development of the cellulose ester industry.

V. Index (patent, name and subject.).

The first thing that strikes one, in looking over the work, is the purpose of Part II. The manufacture of acids is im-



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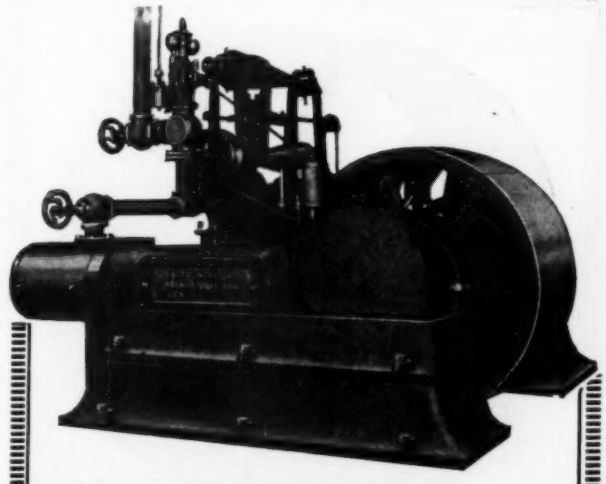

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Paper Mill Economy is assisted very materially by the installation of High Grade Variable Speed and Constant Speed Engines.

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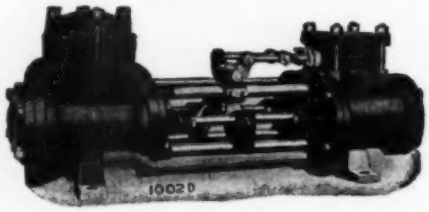

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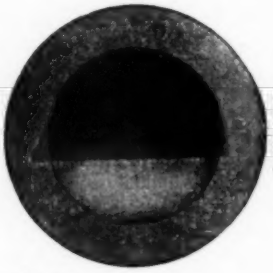
Absolutely balanced; will not pound out of shape

Specify these when ordering new pumps.



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DESIGNED FOR HANDLING

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A genuine combination of durability and real efficiency.

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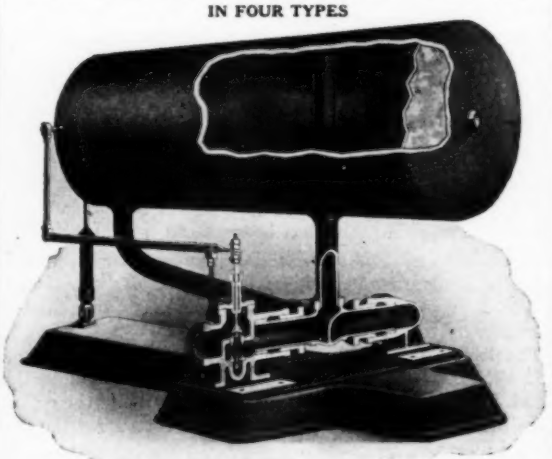
IN FOUR TYPES



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ESPECIALLY ADAPTED FOR PAPER MILL USES

The best trap made to remove the steam condensation from paper machine dryers. Works on a new and improved principle different from any other trap on the market.

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portant, to be sure, but we wonder at the wisdom of making one interested only in cellulose and its products buy this part.

The second thing that impresses one is the very great number of references, specially to patent literature. In most cases there is little but historical interest to the majority of the patents quoted and as far as can be seen, no attempt has been made to evaluate these. It will, therefore, be necessary for the reader to refer to the original patent literature and draw his own conclusions. This is perhaps the greatest fault with the book. The work would have commanded much greater attention if it had been a volume of not over a thousand pages, in which a critical analysis of the situation had been made. Surely "twenty-five years of patient research" should enable an author to make such a contribution, which, to our mind, is the real need of the technical literature today.

Further comment is withheld, as the work must be seen in order to appreciate its advantages and disadvantages. It will then be seen that the work is a very complete bibliography of cellulose and its industries. The reader will often wonder, however, at the arrangement of the material. Fortunately the work has a good index and this makes available the large amount of information scattered through its many pages.

We hesitate to state the price of the work. Volume I is listed at £10 10s. net (postage extra!). There are nine other volumes, the prices of which have not yet been determined. We fear that this will make it impossible for us ordinary mortals to secure a copy, much as we would like it. However, if you have the $40, the price at the present rate of exchange, you may secure the book from E. and F. N. Spon, 57 Haymarket, London, S. W. 1, England.

Connecticut Valley Branch of the Cost Association

The eighth regular meeting of the 1920-1921 season of the Connecticut Valley Branch of the Cost Association of the Paper Industry was held on Monday evening, April 18, 1921, at the Hotel Nonotuck, Holyoke, Mass., with an attendance of forty.

The meeting was a most lively one, and filled right up with the most interesting problems. Mr. J. A. Reilly, president of the local association, opened the meeting with a brief talk on "The Tying in with the General Books." He illustrated his talk with various forms which are used at the American Writing Paper Company. During this period, the attendants took a most active part in the meeting by asking many questions in connection with Mr. Reilly's explanation of this problem.

The next problem which was presented was "The Correct Method of Retiring Un-or-Overearned Burden and Burden Variances from the Cost Ledger to the General Ledger." This subject aroused a real spirit of interest, and a good number of attendants took part in the discussion. The problem as presented, was as follows:

At the closing of the Cost or Mill Ledger, an Unearned Burden was arrived at amounting to $7,000 approximately. The reason for a part of this Unearned Burden was found to be the arriving at too low a departmental rate. After determining a more correct rate and applying same to hours of operation, the difference arrived at, according to general sentiment, was a legitimate additional charge to Cost of Goods Sold or Finished Stock Inventory. This difference reduced the original Unearned Burden of $7,000 to $3,000 approximately. The question was then brought up as to the disposition of this $3,000 and it was answered as follows:

If the account in question, through lack of operation, failed to earn its Burden, it must have reflected saving in the various elements that make up this Burden. This being true, it would resolve itself into a credit variance, and should offset the loss through lack of operation (with the exception of the fixed charges in this account). And they, being standard, would accumulate regularly as an expense, whether they were

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Picks up from either horizontal or vertical position a 72" roll or its equivalent in small rolls.
Stacks on end in car or warehouse.
Easy and simple to handle and will operate all day on a 25-cent charge of electricity.

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"Pioneer Builder of Electric Industrial Trucks"
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Keeps Workmen Healthy

Physiologists agree that in order to keep the body in a normal state of health, a man should drink the equivalent of not less than seven glasses of water each day. Pure drinking water is a primary requisite for hygienic living and helps to keep the body free from all intestinal disturbances.

Stimulate the efforts of your employes and save their time in going to inaccessible hydrants by piping clear, cold water to them by means of Milwaukee's

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This fountain includes a barrel of 1¼" thick oak, painted outside; cover of double thickness; galvanized pipe coil through which water passes to drinking head without coming in contact with ice, and a heavy vitreous china bowl with either cast brass bubbling head with self-closing stop or "Vertico-Slant" stream from which glass can be readily filled.

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with its special Waltham movement, its lock stations and its superior quality throughout, is especially desirable for mills and factories and for either in-door or out-door patrol.

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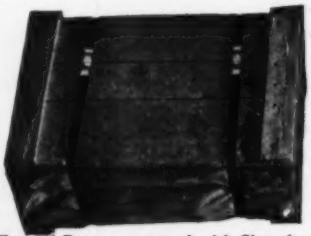

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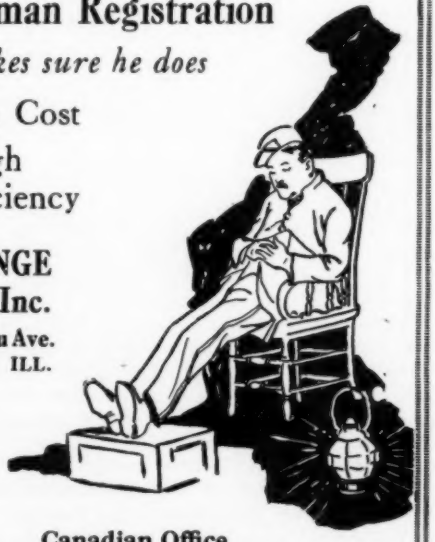

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incorporated in the Burden or written off as an expense. Consequently, this would mean that there had been arrived at both a loss and gain item in this account, which should be retired to the General Ledger under the same account—namely, Un-or-Overearned Burden and Burden Variances. These accounts would be closed periodically and drawn off on the Loss and Gain Statement.

The meeting adjourned at 10:00 P. M.

Kalamazoo Local Division of the Cost Association

This Division held its meeting on April 25th at Kalamazoo, Mich, and Mr. Stephen Gilman of the firm of Tanner, Gilman & Ellis, Certified Public Accountants of Chicago, spoke on "Statistics in Relation to Management Control."

Mr. George Ferguson of the Watervliet Paper Company, Watervliet, Mich, explained the new cost system which has recently been installed in that company by Professor Durward E. Burchell of Harvard University.

Graphic Arts Exposition

The Chicago Club of Printing House Craftsmen will conduct a Graphic Arts Exposition in the Coliseum, of Chicago, on July 23rd to 30th, 1921. It will be held in connection with the Second Annual Convention of the International Association of Printing House Craftsmen.

The exposition is expected to be one of the best of its kind ever held. Every exhibit will be what is called a working exhibit, having machinery or some process in working operation. Nearly all the available space has already been sold.

Robert A. G. Ault

Robert A. G. Ault, general manager of the Schmidt & Ault Paper Co., York, Pa., died on Monday, April 25, after a brief illness, with pneumonia.

Mr. Ault was a resident of York for more than thirty-five years, having arrived there as a young man representing the Standard Oil Co. In 1897 he formed a partnership with John C. Schmidt of that city and leased the Codorus Paper Mills, later organizing the Schmidt & Ault Paper Co., of which he was general manager until the time of his death.

Mr. Ault was an ardent and devout member of St. John's Episcopal Church, of which he had been a vestry man for many years. He was a member of the council of the York County Chapter of the Boy Scouts of America; a member of York Lodge No. 266, F. & A. M., Howall Royal Arch Chapter No. 199, York Commandery K. T. No. 21; a member of the Lafayette Club and the York Country Club, and the Eagle Fire Company; also a member of the Veterans' Association of the 74th Regiment of Buffalo, N. Y., his native city.

As secretary of the York Oratorio Society, when that organization was existent, Mr. Ault performed yeoman service to foster the production of classical music in that city. He was also connected, from time to time, with other enterprises of a civic character.

He leaves his widow and one brother, John B. Ault, of Buffalo, N. Y.

The Chicago office of the Uehling Instrument Co. of New York, manufacturers of fuel saving equipment, was moved May 1st to the Great Northern Building, 20 West Jackson Boulevard. Mr. Walter C. Lange who has been appointed manager of this office is a member of the American Society of Mechanical Engineers and a graduate in Mechanical Engineering of the Stevens Institute of Technology. Uehling CO_2 recording equipment and other boiler room instruments will be on display in the new office.

At a recent annual meeting of the International Paper Co., held at Corinth, N. Y., all of the old directors were re-elected except A. M. Burbank, who was succeeded by Herman Elsas.

Of Exceptional Quality to Meet Every Requirement

We are tank specialists, producing scientifically made tanks that are guaranteed satisfactory in every case.

We are equipped to furnish tanks of any size for any purpose.

We Win With Quality

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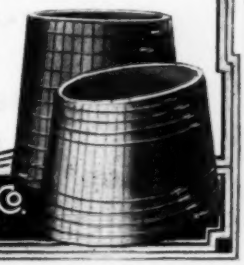

The HAUSER-STANDER TANK Co.
CINCINNATI, O. U.S.A.

JENSSEN ACID TOWERS
at Nekoosa Edwards Paper Co.
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62 Jenssen Tower Installations

GREAT ECONOMY has been effected in mills where the

JENSSEN Two-Tower Acid Systems

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Sixty-two Installations now in operation or building

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G. D. Jenssen Co.
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"Vulcan Brand Means Superior Quality"

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Standard or Multiple Warp

WON'T NARROW, WON'T SHRINK

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High Grade Paper Finishing Machinery

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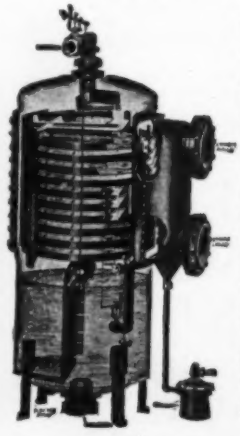

The reason we changed the construction of our heater from cast iron shell to a steel shell was to meet the demand of consulting engineers who specify an open heater to carry from 10 to 15 pounds back pressure. This is particularly necessary in Paper Mills for drying the sheet with exhaust steam. When you put this pressure on a cast iron heater built up of rectangular flat plates you have gone far beyond the limit of safety. That is the reason we use a heavy steel shell. The same principles of heating and purification are carried out as in our old heater.

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SAVE POWER and MONEY

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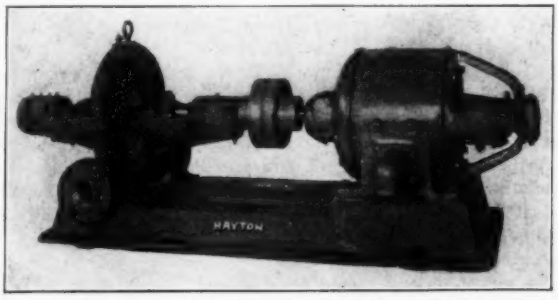

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"With us it is an engineering problem"

Designed especially to meet the requirements of pulp and paper mills. We do not build a pump after OUR ideas and then try to sell it to you. We make a study of YOUR peculiar problems, and then build a pump to suit your needs. Hayton Pumps are built for hard, continuous operation, and will stand up under the most severe usage. We guarantee the highest efficiency, and maximum economy in power consumption.

We also build a full line of Sandusky Triplex pumps.

Let us have your specifications for quotations

Hayton Pump & Blower Co.

Manufacturers

APPLETON, WISCONSIN

Appeal Is Made to Save Old Paper Mill

Every community has its places of local interest but Salt Lake City, Utah, when founded by the intrepid pioneers, was the extreme western end of the civilization of the days when Brigham Young and his followers declared that "this is the place" and though that part of the country was then Mexican territory, he planted the Stars and Stripes on Ensign Peak just north of that city and claimed it for the good old U. S. A., and what's more, made the claim stick.

His wonderful energy vented itself in many enterprises such as building temples, theaters and factories and also sponsored the Deseret Evening News, as a church paper, and it is today the greatest evening paper of the intermountain country.

President Young's idea was to make the far western country absolutely independent of the East by establishing institutions that would supply the people with everything they used; and so, paper mills, sugar, shoe, overall and woolen factories came into being and for the most part have been continued. The first paper mill was established on what was the outskirts of Salt Lake City, but now right in the city, but in 1883 the requirements of the institution made it necessary to secure larger quarters, and so the granite mill at the mouth of Big Cottonwood was erected. It was finished in 1883, and its primary purpose was to furnish paper for the Deseret Evening News founded by Brigham Young, and it served this purpose admirably. The newspaper supply was made from old rags, burlap, etc., and butchers' paper was also made, but this from straw, and the surplus output was sent into nearby states like Montana. The new plant was under the supervision of George C. Lambert, Sr., whose sons are in the paper business there and was in a prosperous condition until the plant was destroyed by fire in 1893, just ten years after its construction.

The granite walls of this old institution stand bleak and bare as a monument to the thrifty pioneers who made that great commonwealth blossom as the rose, and because of the work of vandals, who seem to delight in the destruction of property, valuable for sentimental reasons at least, George D. Alder, of Salt Lake City, took it upon himself to secure the aid of the Commercial Club and Chamber of Commerce of that city to secure co-operation of the city in spending money enough to preserve the ruins, and if possible make a community house there where the people might gather for pastime, and each year on Pioneer Day extol the great work of the first settlers and learn to build more firmly on the foundations they laid, ever remembering their sacrifices for the generations to come.

Forestry Booklet for Boy Scouts

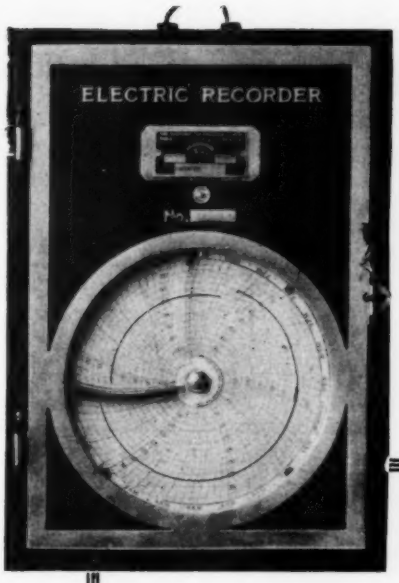
R. S. Kellogg, secretary of the News Print Service Bureau, 18 E. 41st St., New York City, has compiled and caused to be published a leaflet entitled "Forest Trees and Nature Shrubs Which Should Be Looked for in Westchester County, New York." It is intended for the use of Boy Scouts of that county, as a help to them in knowing what trees to look for on their hikes and campaign expeditions.

"While this is not forestry in any respect," says Mr. Kellogg, "a familiarity with the common trees and shrubs is the first step toward an appreciation of our forests, and the knowledge thus gained is a good basis upon which to build sentiment for forest protection."

Mr. Kellogg is chairman of the Woodcraft Committee, Yonkers Council, B. S. A.

Suit Against Paper Company

The Boston & Maine Railroad Company has brought suit for $100,000 against the Erving Paper Mills at Erving, Mass., for damages caused to the plaintiff company by the bursting of a reservoir of the defendant on Miller's River, on Dec. 6, 1920. A freight train which at the time of the break was passing was precipitated into the river, and another train derailed and its contents destroyed.



Let your superintendent know his machines' performance.

He will make them do better.

ACCURACY Tetco PHILADELPHIA PA. U.S.A.

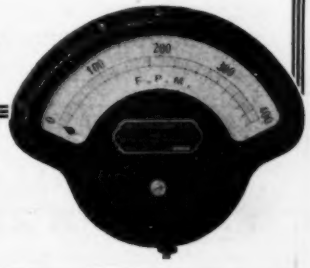
The Electric Tachometer Corporation

Philadelphia

Let your machine tender know his speed.

He will keep it right.

Send for Paper Mill Bulletin



PULP STONES OF QUALITY

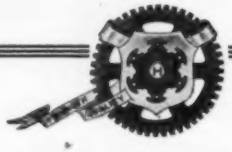
IRONSIDES BRAND

THE CLEVELAND STONE COMPANY has a pulp stone quarry 50 feet in depth with sheets of rock 10 to 15 feet thick and can furnish any size stone now in use.

THE CLEVELAND STONE COMPANY

Eastern Branch
283 Front Street
NEW YORK

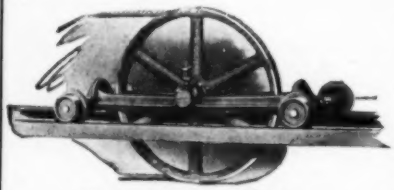
Main Offices
1836 Euclid Avenue
CLEVELAND, OHIO



HILL CLUTCH EQUIPMENT

should not be confused with the lighter lines of power transmission machinery as ordinarily carried in stock by supply houses.

We build equipment fitted for the job and not for the shelves.



Horizontal Tension Carriage

Put your transmission problems up to the Hill Clutch Company's engineers. This service is absolutely free and places you under no obligation.

We manufacture a complete line of efficient power transmission machinery, including the well-known Hill Friction Clutch (Smith Type) and Hill Collar Oiling Bearing.

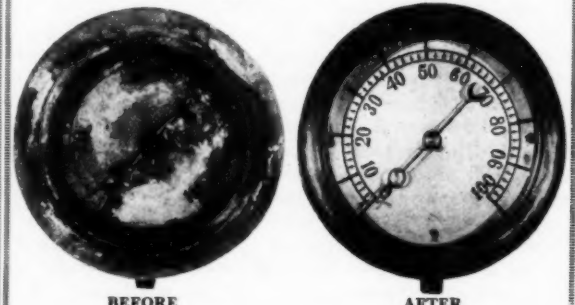
Catalog and Bulletins upon request

THE HILL CLUTCH CO.

General Office and Plant
Cleveland, Ohio

New York Office
50 Church St.

Old Gauges Made New



BEFORE AFTER

Specializing Pressure Gauge Repairing All Styles, All Makes, Including Pyrometer and Recording Gauges, Marine Clocks and Rev. Counters

REGARDLESS OF WHO MANUFACTURED YOUR GAUGES, Regardless of their CONDITION, we GUARANTEE to put them in First Class Working Condition

We request you to send one gauge to be repaired—no charge—as a sample of the quality and delivery of our work.

Immediate delivery of work that is uniformly excellent, at a satisfactory cost.

The Manning Gauge Company, Inc.
77 Traverse Street, BOSTON, MASSACHUSETTS

RETURN TUBULAR LOCOMOTIVE **BOILERS** WATER TUBE SCOTCH MARINE

A LARGE STOCK OF HIGH-GRADE BOILERS OF PRACTICALLY ALL SIZES, TYPES AND MAKES, TAKEN OVER FROM DU PONT CHEMICAL COMPANY'S AND OTHER PLANTS WITH PRODUCTION RECORDS — RECONDITIONED, OFFERED SUBJECT TO ANY INSPECTION, AVAILABLE NOW!

"SAVE TIME AND MONEY ON YOUR POWER INSTALLATION — LET **DAVIS** FURNISH THE BOILERS"

LONG DISTANCE TELEPHONE
RANDOLPH 2233

J. F. DAVIS

1122-1123-1124 HARRIS TRUST BUILDING
CHICAGO, ILL.

Sigmund Goldman Receives Handsome Gift

A very unique token was presented on April 7th to Sigmund Goldman, president of English China Clays Sales Corporation, New York, by the Association of American Wood Importers, the occasion being his retirement from the office of president of the Association. It consisted of a Tiffany Repeater gold watch, chain and cigar cutter. The unique feature about the watch is its ability to tell the time by means of a gong which strikes when a lever is pulled out at the side of the watch, thus rendering it invaluable when a light is not available.

The Association of American Wood Importers was started eleven years ago, and Mr. Goldman has been secretary and afterward president since the organization.

New Asbestos Gypsum Hood Announced

The trade will be interested in the announcement of a new development in the form of a paper machine hood for which the makers claim quite a range of distinctive advantages, not the least of which is the feature of being firepoof.

The Management Engineering and Development Co., well known pulp and paper mill engineers of Dayton, Ohio, have conceived, designed and perfected this unique innovation which it would seem cannot fail to hold an interest for paper manufacturers everywhere. In Canada the hood will be introduced through H. S. Taylor, Ltd., Guarantee Bldg., Montreal, Quebec.

Among the advantages which the introductory advertisement announces are the facts that this hood is especially adapted for replacement and can be installed without special shutdown. It is light in weight, practically indestructible, easily ventilated, guaranteed not to drip, low first cost and no maintenance cost, offers great saving in felts, conforms to ideal machine room conditions and endorsed by the underwriters. Further particulars may be secured direct from the makers as named above.

Foreign Trade Financing Corporation Endorsed by American Bankers Association

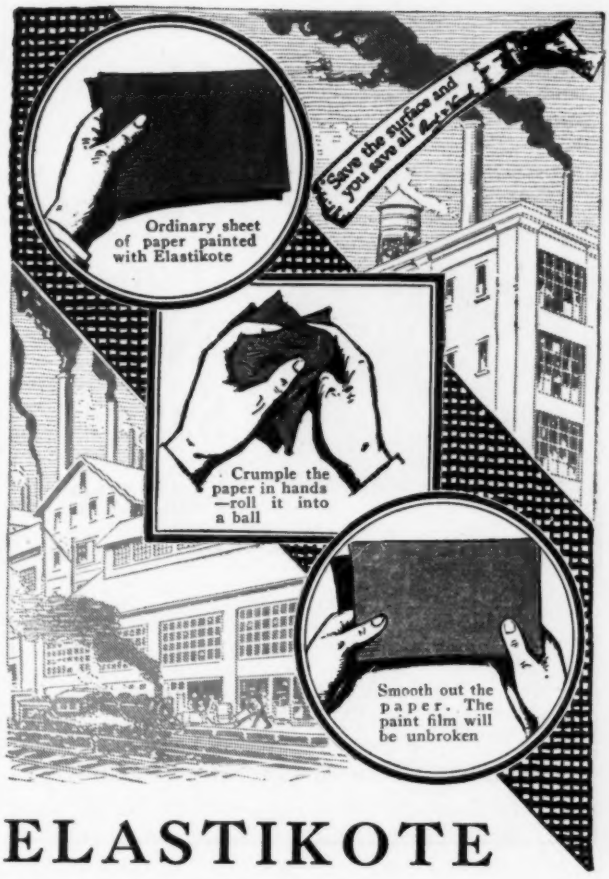
The emphatic endorsement given to the Foreign Trade Financing Corporation by the Executive Council of the American Bankers Association is shown by the following resolution which the council unanimously adopted at its meeting at Pinehurst, N. C., this month.

"The need is apparent for bringing into operation at the earliest possible moment financial machinery adequate for the extension of long-term credits, looking to the restoration and expansion of our foreign trade. As a solution to this problem, the Foreign Trade Financing Corporation was inaugurated, and is in process of organization, with the endorsement and sponsorship of the American Bankers Association. The Executive Council of this association reaffirms its faith and support in this agency for trade rehabilitation, and urges in the strongest and most unqualified manner the wholehearted cooperation of the banking and business interests of the country, that it may speedily begin to function for the benefit of America and the world."

The Crown-Willamette Pulp & Paper Co. has advised their employes that they will buy groceries and canned goods at wholesale and sell them to the employes at a little over the wholesale cost price to protect them from profiteers. The plan will be tried out first at the plants at Camas and West Linn, Wash.

Heads Pulp and Paper Section at Forest Products Laboratory

Mr. John D. Rue has joined the staff of the Forest Products Laboratory at Madison as chief of the section of pulp and paper investigation, following the resignation of Dr. Otto


Ordinary sheet of paper painted with Elastikote
Save the surface and you save all
Crumple the paper in hands —roll it into a ball
Smooth out the paper. The paint film will be unbroken

ELASTIKOTE

Never Cracks

Resists Acid Fumes

Lasts for Years

Make This FREE Test

Send for this free test of Elastikote—the paint prepared especially for use on industrial buildings. See for yourself that Elastikote can't crack. Note its elasticity and why Elastikote withstands conditions ordinary paints cannot resist. Learn why America's leading industries have been using Elastikote for years.

Just have your stenographer attach this advertisement to your letterhead—for complete details and this free test.

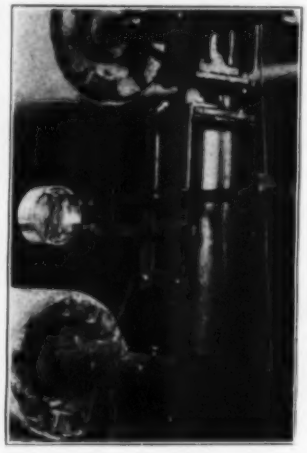
THE TROPICAL PAINT & OIL COMPANY

"The Firm that Serves with What Preserves"

CLEVELAND, OHIO

TROPICAL

Paints—Enamels—Roofing Materials



Have You Heard of the

New Safety Device

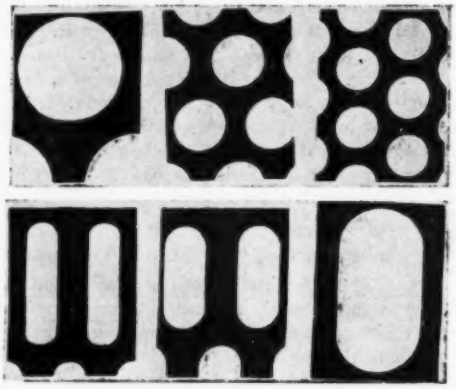
for your PAPER MACHINE REELS?

The Object Is—TO AVOID DRAGGING MEN AND CLOTHING IN BETWEEN REELS

Nekoosa Motor & Machine Company

We Solicit Your Inquiries Nekoosa, Wisconsin

Perforated Metal Screens



Of Copper, Brass, Steel, Bronze, or Any Other Metal

Perforations of All Sizes and Shapes for Use in Pulp and Paper Mills in

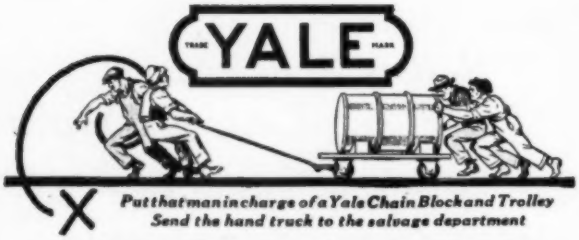
Centrifugal Screens, Drainer-Bottoms, Filter Plates, Pulp Washers, Suction Box Covers, Etc.

Accuracy in all details and excellence of quality at lowest consistent prices

The Harrington & King Perforating Co.

615 North Union Avenue CHICAGO, ILLINOIS, U. S. A

NEW YORK OFFICE, 114 LIBERTY STREET



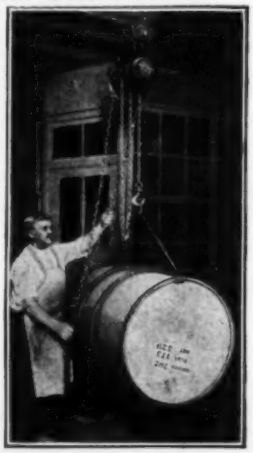
Put that man in charge of a Yale Chain Block and Trolley
Send the hand truck to the salvage department

And you can put the other three men to *work*

HAND trucking costs too much money. You can't afford to squander needless physical effort when muscle costs so much.

Yale Chain Blocks and I-beam Trolleys are justifiable investments at any time—but especially at this time when it is so necessary to cut all costs.

Yale hoisting and conveying systems include also electric hoists, and electric industrial trucks and tractor and trailer units. Sold by machinery supply houses. Ask your secretary to write us today for descriptive bulletins.



The Yale & Towne Mfg. Co.

Stamford, Conn. U. S. A.

Yale Made is Yale Marked

Yale Hoisting & Conveying Systems

DO YOUR HOISTING WITH

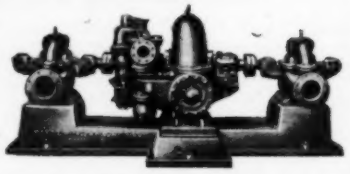
NORTHERN CRANES

and ELECTRIC HOISTS Catalogs Free

NORTHERN ENGINEERING WORKS. DETROIT, MICH.

EARLE

CENTRIFUGAL PUMPS



For Service Where Quality Counts

THE EARLE GEAR & MACHINE CO.

4711 Stenton Ave., Philadelphia, U. S. A.

Kress from this position. Mr. Rue was previously associated with the Mead pulp and paper interests and took a prominent part in the work carried on by that organization in cooperation with the laboratory during the past two years. He received the degree of M. A. from Princeton University where he specialized in organic and physical chemistry. He also took post graduate work in chemical engineering abroad at Heidelberg University, and the Zurich Polytechnikum. During the war he served as captain in the Gas Service at Edgewood Arsenal.

Reports Big Supply of Pulp Wood in Alaska

There is sufficient pulp wood in Alaska to furnish perpetually one-third of the print paper consumption in the United States, Col. Greely, chief forester, who recently made a survey, is reported as saying. This could be put down on the Atlantic seaboard on a basis of between 3½ and 4 cents a pound, based on present rail freight rates, and practically 1 cent a pound by water, he said.

Announcement was made at Juneau, Alaska, on the 7th, that the Alaska-Gostineau Mining Co. and the Perseverance Mine at Thow will close on May 31, and that the hydro-electric plant will be used by a pulp mill which is being erected there.

Canadian Paper Exports

Canadian exports of pulp and paper for the month of March were valued at $12,407,476, compared with $11,668,769 for the month of March, 1920, a gain in value of $738,680, and were $3,738,661 above those reported by the Dominion Bureau of Statistics for the month of February, 1921.

In comparing the volume of business the tonnage of newsprint for the month of March, 1921, was 75,773 tons, as against 71,307 for March, 1920. With the exception of bleached sulphite pulp, shipments of which were valued at $1,005,260, as compared with $841,699 in March, 1920, pulp shows a decrease in volume and value.

New Mill at Leavenworth

The Odell Poultry Corporation of Decatur, Ill., has moved to Leavenworth, Kan., and it is stated will build a board mill, the product of which will be turned into egg case fillers. Machinery is now being perfected to manufacture a new style egg case filler, the compartments holding the eggs to be cup-shaped. It is said eggs will ship much better in this style of container than that generally in use.

New Pulp Mill in Texas

The new Trinity Paper Mills, of Commerce, Texas, is now turning out paper stock from cotton linters.

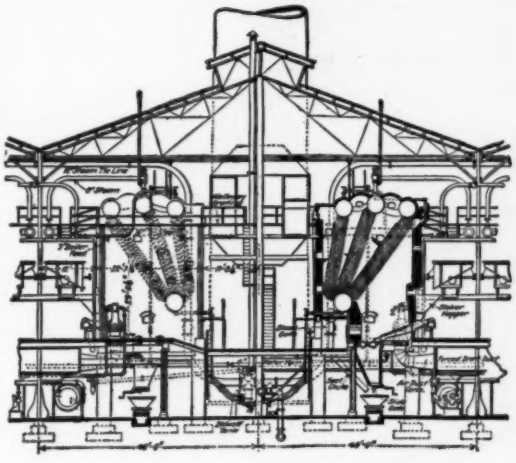
"There are 600,000 to 900,000 tons of linters available for paper stock in the South every year," said Mr. Lull, president of the company, "and as the wealth of America is largely in its waste products it is intelligent and practical to extract as much profit as may be possible from such sources. Our plant at Commerce is small, but we are optimistic over our prospect of the not distant day when we shall manufacture our pulp into paper right here at home. At present we must ship our pulp north, where it is made into book and writing paper.

"Paper from cotton linters is no longer in the experimental stage. There are four mills east of the Mississippi River, with a combined capacity of 350 tons daily. These mills have been operated for more than a year. One is at Memphis, one at Augusta, one at Hopewell, Va., and one at Nitro, W. Va."

High water has been causing considerable trouble to the paper mills at Neenah, Menasha, and Appleton, Wis. Several mills have been compelled to temporarily close down on this account.

Brand New Boilers at Low Prices

Immediate Delivery



JK 3056 44—823 H.P. B. & W. Stirling boilers, ASME CODE, built for 200 lb. pressure, suspended setting; equipped with Westinghouse stokers; each has 3 steam drums 42″ dia. x 17′1⅞″ long, plates ⅞″ thick, one mud drum 48″ dia. x 16′7⅝″ long, plates 1″ thick and 630 tubes 3¼″ dia., 8226 sq. ft. heating surface. Delivery including catalog fittings, stokers, breeching, extension hoppers and soot blower; stoker engine will be included with purchase of two batteries (4 boilers) without extra cost. Forced draft apparatus complete for two batteries, extra.

CG 601. One 440 H.P. B. & W. water tube boiler, A.S.M.E. code 200 lbs. working pressure, 2 drums 42″ x 20′4″ 18 sections of 12 tubes, 4″ dia. x 18′ long. Drums ½″ thick; butt-strapped. Forged steel vertical headers. Steam outlet 6″ dia. 12½″ flange. Catalog fittings. Brand new, never erected.

A Complete Line of Power and Pulp Equipment: Beaters, Condensers, Engines, Evaporators, Feed Water Heaters, Generator Sets, Pumps, etc.

Write for "T. P. Economist"

Technical Products Company

INCORPORATED

Chicago 501 Fifth Ave., New York Toronto

"STEEL MIXTURE"

Lower Prices! Higher Values!

You can get no greater value in boiler settings than from "Steel Mixture." "Steel Mixture" Arches, Blocks, etc., cost less to install because of the fewer parts—7 for a Door Arch, 12 for a Back Arch, 10 for a lining around the Fire Box. They cost less to maintain because they do not have to be repaired every once in a while. They will last more than twice as long as small brick linings and thus save the cost of one or more re-installations.

You need hold back no longer for lower prices because "Steel Mixture" PRICES ARE DOWN TO 1917 LEVEL. This means that you can make some very necessary repairs to your boiler setting at once with the best material obtainable and at the reasonable prices you have been waiting for. NOW IS THE TIME TO START THINGS GOING.

Write us at once for information about Boiler Door Arches, Fire Box Lining Blocks, Back Combustion Chamber Arches, Blow-Off Pipe Protectors, Ignition Arches or Dutch Ovens. We ship from stock immediately; everything fitted to your exact requirements.

McLEOD & HENRY CO.
TROY, N. Y.

PI-5

This form for your convenience

McLeod & Henry Co.,
Troy, N. Y.

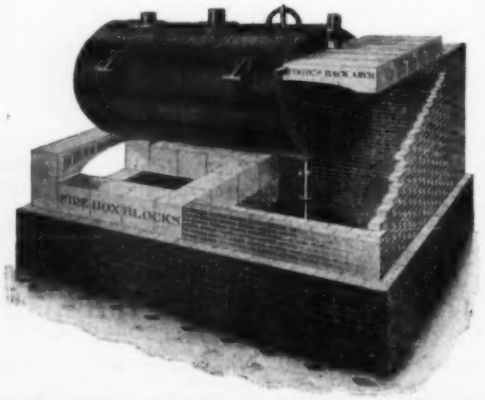
Gentlemen:

Please send without obligation information on "Steel Mixture" covering items checked below.

☐ Boiler Door Arches.
☐ Back Combustion Chamber Arch.
☐ Blow-Off Pipe Protectors.
☐ Fire Box Lining Blocks.
☐ Dutch Ovens.
☐ Complete outfit (give name and style of boiler).

Name .....

Address .....



BAILEY FLUID METERS
CUT STEAM WASTE

and give reliable, comprehensive information to those whose interest is centered in efficiency and operating costs.

Bailey Fluid Meter—Type C2, Class 24

Three kinds of correlated information are shown on chart.

1—The rate of steam flow
2—The steam pressure
3—The steam temperature

among BAILEY FLUID METER users are

American Writing Paper Co.
Great Northern Paper Co.
International Paper Co.
Dennison Manufacturing Co.
Laurentide Co., Ltd.
St. Maurice Paper Co., Ltd.
The Riorden Co., Ltd.
Strathmore Paper Co.
Lake Superior Pulp & Paper Co.

Let Our Engineers Help You

The BAILEY METER COMPANY
2023 East 46th Street, CLEVELAND, OHIO

New Board Mill at Monroe, Mich.

At a meeting of the new Consolidated Paper Company, held at Monroe, E. C. Rauch was elected president; H. L. Rauch, vice president and general manager; Eugene C. Betz, F. E. Williamson, of New York City, L. W. Leathers, and J. C. Tullis, were also named as vice presidents, W. C. Tullis, secretary, and L. W. Newcomer, treasurer.

The capital stock of the company was increased to $7,500,000, of which $2,500,000 is in preferred stock, and $5,000,000 in common stock.

It is rumored that the new company will build a strawboard mill.

The Escanaba, Mich., Paper Co.'s plant at Groos is now getting power from the new $1,000,000 dam at Boney Falls. Twelve pulp grinders are now hitched to this new source of power.

At the annual meeting of the stockholders of the International Paper Company at Corinth, N. Y., on April 28, all of the former directors of the company were re-elected, with the exception of A. N. Burbank, who was succeeded by Herman Elsas. Mr. Elsas is president and general manager of the Continental Paper & Bag Mills, of New York City.

Fire practically destroyed the grinding department of the Iroquois Pulp & Paper Co.'s mill at McKeever, N. Y., on May 4. The fire started while the men were at lunch. The entire department was gutted, but the rest of the plant was saved.

Work is being rushed on the new plant of the Ogdensburg Paper Co., Ogdensburg, N. Y. It is hoped to have the plant ready for operation by some time in July.

Alvan T. Simonds Economic Prize Awards

The prizes offered by Alvan T. Simonds, President of the Simonds Saw Manufacturing Company, Fitchburg, Mass., to encourage the study of economics in high schools and normal schools, of $1000 and $500 for the two best essays on the subject "Present Economic Conditions and the Teachings of Adam Smith in the Wealth of Nations," have been awarded by the judges as follows:

First Prize of $1000 to
David Koch,
High School of Commerce
New York City
Second Prize of $500 to
Aloysius Thiemann
Reedsburg High School
Reedsburg, Wis.

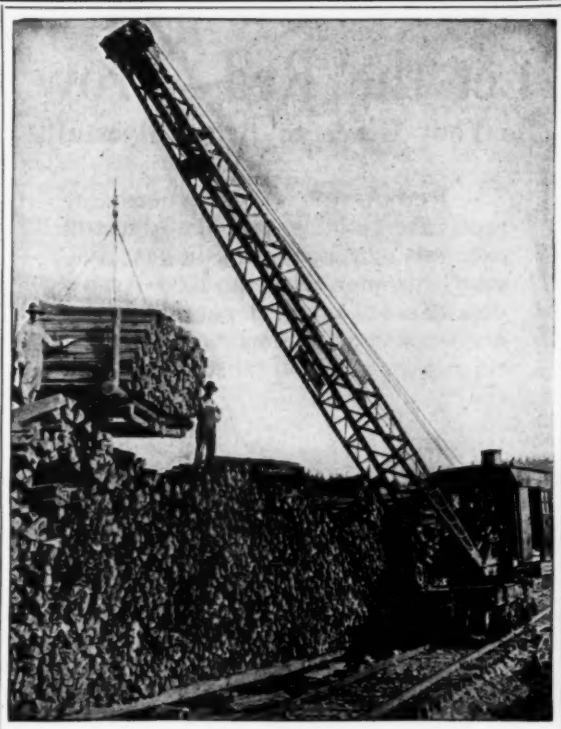
Essays were submitted from every section of the United States and from Canada. Practically every state was represented. A very large proportion came from New York City, where the study of economics is required of all seniors in the high schools.

The judges were Wallace B. Donham, Dean of the Harvard School of Business Administration, Cambridge, Mass., and John G. Thompson, Principal of the State Normal School (On leave), Fitchburg, Mass.

Calco Chemical Co. Opens Philadelphia Office

Users of intermediates and dyestuffs will be interested to know that the Calco Chemical Company of Bond Brook, N. J., has opened a Philadelphia office at 106 Chestnut Street.

This office will carry a stock of the entire Calco line of dyestuffs and intermediates. The purpose of the company in establishing this branch with a complete sales organization, is to enable them to be more closely in touch with the Philadelphia trade and to insure prompt delivery of all orders.



BROWNHOIST

Handling Materials at the Mill

IS YOURS one of the many mills which handles considerable pulp? Some of these have found it to be more rapid and economical to do this handling with a Brownhoist locomotive crane. A Brownhoist will not only place the pulp wherever it is needed, but will handle your coal, switch the cars and take care of innumerable jobs which come up around the yard. If you have much handling to do, our long crane experience should be of use to you. We will gladly give you any information for the asking.

The
Brown Hoisting Machinery Co.
CLEVELAND, OHIO, U.S.A.

Engineers and Manufacturers of Heavy Dock Machinery, Bridge Cranes, etc., as well as smaller Cranes and Hoists

Branch Offices in New York, Pittsburgh, Chicago and San Francisco.

Let the Red-Arrow
Be Your Guide to Better Dyestuffs

The **Red-Arrow** is rapidly becoming recognized as the symbol of dyestuff excellence. When you purchase dyestuffs branded with the **Red-Arrow** you can always feel confident you are getting a dye with the highest tinting power and absolutely consistent in quality.

If you have a special dye problem or wish any particular formula, our service Department of Color Chemists will be glad to assist you without incurring any obligation on your part.

DICKS, DAVID COMPANY
INCORPORATED
Main Office, 19-21 North Moore Street, New York, N. Y.
Boston, Mass. Chicago Heights, Ill. Paterson, N. J.
Charlotte, N. C. Glens Falls, N. Y. San Francisco, Cal.

Red-Arrow Dyestuffs

FOR SALE

Some Bargains in First-class Used Tanks:

190—4′ x 6′ long, ¼″, 584 gal. cap.	$ 85
3—4′6″ x 24′ long, ½″, 2,853 gal. cap.	175
2—7′ x 18′ long, ¼″, 5,129 gal. cap.	300
12—8′6″ x 18′ long, 5/16″, 7,640 gal. cap.	450
7—10′6″x16′6″ long, ⅜″, 11,200 gal. cap.	525
3—6′ x 6′ long, ½″, 1,269 gal., for 250 lbs.	275
2—5′6″ x 12′ long, ¾″, 2,132 gal., for 350 lbs.	550
1—25′ x 14′ high, ⅜ and ¼″, 51,000, ¼″ roof.	850

THE CURTISS-WILLIS CO., Tank Dealers
30 Church Street New York City

FOR SALE

2—1800 lb. Brand New Beaters, never installed, Rolls 61″x48″, immediate delivery. For detailed specifications and prices Address Box 1075, c/o The Paper Industry.

THE NEWPORT COLORS *for Paper*

We are manufacturing an extensive range of high-grade products for the paper maker. We particularly call your attention to our

Newport Direct Yellow G
and
Newport Brilliant Yellow

The former is the true Stilbene product and the latter is the prototype of pre-war Paper Yellow 3G.

NEWPORT
TRADE MARK
"COAL TO DYESTUFF"

Newport Chemical Works, Inc.
Passaic, New Jersey
Branch Sales Offices
Boston, Philadelphia, Greensboro, N. C., Chicago
Providence

DAVIS Valve Specialties include many paper mill necessities — pressure regulators for steam, air or water, steam traps, balanced valves and a number of other steam savers.

The Pressure Regulator, or reducing valve, shown opposite is very simple in operation. It cannot get out of order or cause trouble. Therefore there are no springs and no diaphragms to break. Operation is controlled by gravity—and the Davis Pressure Regulator is as dependable as the force of gravity.

Other Davis valve equipment for paper mills is just as simple—and just as dependable. Every paper man should have a copy of the Davis engineering catalog. For your free copy, just address the G. M. Davis Regulator Co., 414 Milwaukee Ave., Chicago.

DAVIS VALVE SPECIALTIES
STEAM SAVERS SINCE 1875

Sandy Hill Iron & Brass Works Annual Meeting

At the annual meeting of The Sandy Hill Iron and Brass Works, held at Hudson Falls, New York, May 2nd, 1921, the following directors were elected for the ensuing year:

A. J. Kennedy, C. W. Kellogg, J. M. Ferris, R. C. Tefft, Jr., and H. L. Broughton.

Following the stockholders' meeting the directors met and elected the following officers:

A. J. Kennedy, president; R. C. Tefft, Jr., vice-president; and J. M. Ferris, secretary-treasurer.

Chicago Fuse Co.'s New York Office Moves

Following the general business trend, the New York offices of the Chicago Fuse Mfg. Co. have removed from the crowded downtown section to the more accessible center of the city.

No doubt users of "Union" Fuses, Boxes, Cutouts, etc., will find their spacious new offices, located in the Tilden Building, 105 West 40th Street, much more convenient.

Geo. H. Gibson Co., consulting engineers of New York City, announce the removal of their offices to the top (18th) floor of the Hide and Leather Building, 100 Gold Street, corner of Frankfort Street and South of Brooklyn Bridge. This building is said to be the highest concrete structure in the world.

The Chicago branch store of the Lunkenheimer Company, manufacturers of engineering specialties, moved from 188 North Dearborn Street to 568 West Washington Boulevard effective May 1st, 1921.

Price & Pierce, Ltd., of New York City, pulp agents, have removed their offices to 17 East 42nd St., corner of Madison Ave., directly opposite their old quarters.

The Stamsocott Company, Inc., of Hopewell, Va., one of the leading manufacturers of cotton linter pulp for paper mills, has established a head sales office in Suite 2822 of the Battery Park Building, 17 Battery Place, New York. S. E. Seaman is general sales manager.

The directorate of the Union Bag and Paper Corporation has been reduced from fifteen to eleven members. T. M. Day, J. H. Darby, E. B. Osborne and J. E. Sleicher on the old board were re-elected at the recent annual meeting. Officials were also re-elected at the organization meeting.

L. F. Hayward, who for a long period was manager of the New York sales office of the American Writing Paper Company prior to about a year ago, when he resigned to enter a jobbing firm in New York, has been appointed Eastern representative of the Fox River Paper Company, of Appleton, Wis., with offices at 261 Broadway, New York City. The Fox River loft and machine dried papers have been favorably known for many years, and Mr. Hayward will endeavor to market a larger part of the company's daily output of sixty tons among Eastern consumers than has been heretofore used in that section.

Edward B. Cowles, whose father at one time was head of the Pejebscot Paper Company, is now representing the Bedford Pulp and Paper Company, of Richmond, Va., as Eastern sales agent, with offices at 411 Fifth avenue, New York City.

The New York sales office of the American Straw Board Company has been moved to larger and more centrally located quarters in the Woolworth Building.

Holden & Hawley, Inc., among New York City's leading paper jobbing concerns, removed on May 1 from Beekman street to their new building at 196 West Broadway.

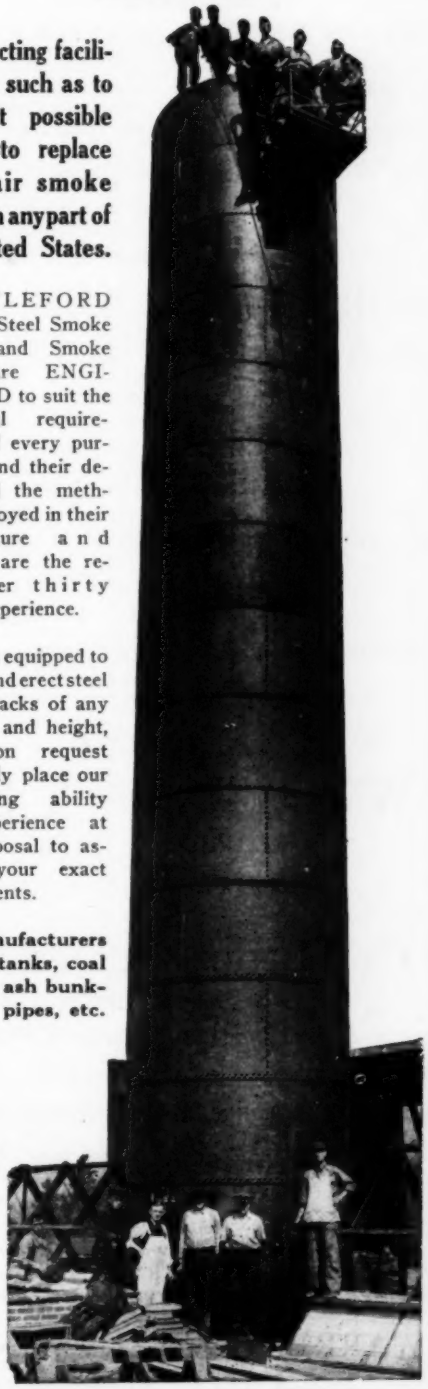
SMOKE STACKS
BREECHINGS
TANKS

Our erecting facilities are such as to make it possible for us to replace or repair smoke stacks in any part of the United States.

LITTLEFORD BROS. Steel Smoke Stacks and Smoke Flues are ENGINEERED to suit the individual requirements of every purchaser, and their design and the methods employed in their manufacture and erection are the results over thirty years' experience.

We are equipped to furnish and erect steel smoke stacks of any diameter and height, and upon request will gladly place our engineering ability and experience at your disposal to ascertain your exact requirements.

Also manufacturers of steel tanks, coal bunkers, ash bunkers, coal pipes, etc.



LITTLEFORD BROTHERS
500 East Pearl Street Cincinnati, Ohio

UNION SCREEN PLATE CO.
Fitchburg, Mass., U. S. A. Lennoxville, P. Q., Canada

UNION BRONZE SCREEN PLATES
(Best phosphorized Cast Metal)

Old Plates RECLOSED and RECUT to accurate gauge
UNION BRONZE SCREWS for Screen Plates
Immediate Delivery of the Largest Orders. Satisfaction Guaranteed

The Witham Screen Plate Fastener, Patented
THE ORIGINAL THE BEST

THE ROBERT ANDREWS CO.
115-117 Franklin Street, New York

Paper Makers' Supplies

Flax Waste	Linen Thread Waste
Italian Hemp Waste	Linen Cuttings
Flax Spinners Waste	Jute Waste

Samples and Quotations on Request

SCREEN PLATES *and* **DANDY ROLLS**

Watermarking a Specialty

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The Quick Service House
KALAMAZOO MICHIGAN

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NEW YORK

FOREIGN AND DOMESTIC
PAPER MAKERS' SUPPLIES
CHEMICAL and MECHANICAL PULPS
COTTON, JUTE AND FLAX WASTES
EAST INDIA MERCHANDISE

Remember
WM. A. HARDY & SONS
FITCHBURG, MASS.
Originators and Oldest Manufacturers
OF THE
Cast Bronze Screen Plate
ALSO SPECIALIZE IN
Acid Resisting Digester Parts

PENN PAPER & STOCK CO.

Assorted Waste Paper in Large Quantities

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Ticonderoga Machine Works
TICONDEROGA, N. Y., U. S. A.
MANUFACTURERS OF
WARREN IMPROVED CALENDER **DOCTORS**
With Flexible Blades, Universal Adjustment and Control
(PATENTED)
WARREN IMPROVED PATENT DOUBLE DRUM **WINDERS**
Patent BALL VALVE Hydrant
Stock Circulating Systems *and*
other Paper Mill Specialties
SEND FOR OUR BULLETIN

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EMANUEL SALOMON, President
347 Madison Avenue, New York
Paper Makers Supplies
SOLE AGENTS U. S. *and* CANADA *for*

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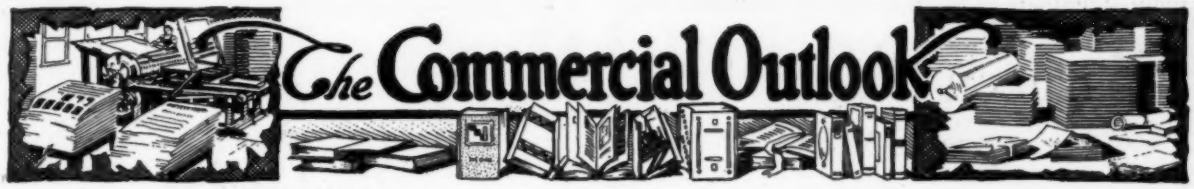
Rouen, France	*Annonay, France*



EVIDENCE is accumulating that trade activity in the various grades of paper is on the rise. Consumers in general are still buying in hand-to-mouth style, but improvement in many lines of commercial endeavor is such that increased amounts of paper are required, and this is bringing more buyers into the paper market and for larger quantities. It is hardly to be expected that demand for any kind of paper will revert to normal proportions during the next several months. The summer season is proverbially a quiet period in the paper industry, and this condition is likely to be accentuated to no little extent during the approaching summer, but at the same time nearly everyone looks to see demand for paper increase in volume over that during the dull period of the past few months, and indications are that matters are shaping up as anticipated that the market is headed toward broader activity and a full stabilization of prices.

It can be said that practically all kinds of paper are sharing in the business improvement. Printers and publishers, paper converters and treaters, paper box and papeterie manufacturers, retail merchants; in fact, all consumers of paper and paper board are buying in at least a little better volume than has marked their operations in the paper trade in recent months. It is true that the average user of paper is placing orders merely when in immediate need of supplies, but this is proof positive that the present demand is of the healthiest character; that buyers are absorbing paper not to be stored up because they feel that prices are scraping bottom but for direct consumption. Reports from mill centres mostly tell of curtailed operations in paper producing plants. A majority of mills are not running at more than 50 per cent of capacity today, yet most of them are operating at larger capacity than a month ago, and they are finding an outlet not alone for the paper now being manufactured but also for some of the stock which has been accumulating during the last half year.

Jobbers appear to be regaining confidence in prices and to be adding to their holdings. For quite a lengthy period, jobbers with few exceptions bought from mills only when having orders from their customers immediately in hand, but now there are indications that paper merchants are again stocking up their shelves to at least an extent so as to be prepared to effect quick deliveries to customers.

The strike of operatives in news print and pulp mills in the United States and Canada has created an entirely changed condition in the print paper market. Inquiry from publishers has broadened considerably, and there has been quite a pick-up in business in spot news print. With the possibility of a shortage of news print developing, with leading producers who are affected by the strike refusing to make commitments regarding forward deliveries and with manufacturers and dealers in general displaying a much firmer attitude relative to prices, publishers in numerous cases have augmented their stocks of news print through purchases in various directions, thus making for a distinctly livelier market tone. It is generally conceded that available supplies of newsprint are ample to cover the normal requirements of publishers for a period of between six and seven weeks, but it is also appreciated that should the strike of mill workers last for this length of time that a critical shortage of print paper would doubtless ensue. It is this latter situation of course that is attracting consumers to the market at present and is productive of a stronger price tone.

An actual advance in quotations on fine tissue papers has occurred—something that probably has not happened in this branch of the paper market since prices first began receding about a year ago. After having worked down to about 85 cents per ream on No. 1 white tissue, basis 20x30, and on No. 2 white and No. 1 manila, 24x36, leading manufacturers a few days ago marked up prices to 95 cents a ream, and are reported as standing firm for this figure. There is a fairly good trade in fine tissues, while low-grade tissue papers such as toilet, towels and napkins, are moving in steadily increasing volume, representing one of the most active kinds of paper in the market today.

Book papers have sagged to lower levels. Machine finished book is available in at least some quarters at close to 7 cents per pound, while supercalendered book is quoted at 10 cents and less, and coated book at as low as 11 cents.

Fine papers are in a fairly steady price position and demand appears to be gradually expanding. As an instance of the improvement taking place, a report just issued by the American Writing Paper Company says that last week was the best of any so far this year for the products of that company. The latest report of the Federal Trade Commission shows that mill stocks of writing papers as of March 31 were larger than of any other kind of paper, aggregating about 33 days' average output, and this probably accounts for the fact that the increased demand for fine papers is not as forcibly reflected in mill operations as in other lines of paper, the average fine paper plant running at present at no better than 40 per cent of full capacity.

The board market is livelier than it has been in some time. Consumers are taking larger amounts of board and prices seem to be undergoing a hardening process. Plain chip board in the East is quoted at a minimum of $30 at mills, with most producers naming higher prices, and filled news board is held for $35 to $40 per ton.

Conference of Test Board Mill Representatives

A conference of representatives of Test Box Board Mills having normal capacity of about 1800 tons daily was held in Chicago on April 20th. A full and fair discussion brought out the fact that the average present cost of 100 test Board is $79.62 per ton at mills. This cost was computed upon a 100 per cent output. The present demand—less than 50 per cent of capacity—imposes a manufacturing cost of approaching $100 a ton on 100 Test Board.

To minimize losses to the mills, it was estimated and agreed that operating alternate weeks would effect a saving over operating from one to five days each week, as mills have been doing for the last six months. An informal discussion favored the conclusion that the selling of 100 Test Board at less than $80 a ton at mills would be at variance with business logic and against public policy.

While the present market conditions and immediate outlook were very disheartening, "Hope, the leading string of Youth" and bearing burdens equitably seemed to be manifest in the "Heart to Heart" talks at the gathering. The thought of profits was not in evidence. The minimizing of losses was the matter of much concern and had general support.

The general and sales offices of the Victory Bag & Paper Co., of Chicago, has been moved to Marinette, Wis.

Bardeen Paper Co.

Otsego, Mich.

Printing Papers of Merit

For LETTERPRESS, OFFSET *and* LITHOGRAPHIC PRINTING

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Porcelain, Peninsular and Purity Enamel Book

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Rags, Bagging, Rope and Waste Paper

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Now Is the Time to Buy Our Raw Materials

Out of the forty different kinds of paper stock graded in our many large warehouses, you are assured a steady, reliable source for procuring raw materials in practically every branch of paper making.

Having specialized for 35 years in this one field you can depend upon a clean, well-packed, uniform product throughout; fulfillment of delivery promises; and because of our output of 300 tons daily, big tonnage at all times.

Write us your wants and we'll gladly send further information.

Mendelson Bros. Paper Stock Co.

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Long Distance Phones: Harrison 2840 and 5557.

Domestic Raw Materials

Papermaking Rags

Trade activity in papermaking rags, along with that in practically all kinds of papermaking material, is at present of narrow scope. Mills are buying almost entirely in hand-to-mouth fashion, and with the average paper mill running at only about half capacity, there is not the need for anywhere near as many rags as paper manufacturers usually consume. Moreover, a good many mills are still using raw material bought some time ago and which has since been held in store, and this also eliminates considerable demand for rag stock.

It is difficult to describe the actual condition of the rag market. Easiness of tone is the most apparent characteristic, and as a matter of fact there is scarcely enough of certain grades moving to establish a market. It is not uncommon for rag values to tend off at this season of the year when collections through country sections are in full swing and when dealers seek to sell and consumers hold back in buying, but the situation in this regard has been greatly accentuated this spring by the exceptionally light demand emanating from mills. There is little doubt but that collections during the past several months have been smaller than normal, yet the decrease in supply is more than offset by the sharp diminishment of demand. Rags are a commodity that are worth literally their weight in gold when in active demand, but their value depreciates to almost nil when consumers do not want them. The lack of demand is the basic reason for the prevailing market situation, and there is little likelihood of improvement until paper mills are more in need of supplies and increase their buying.

From all indications, stocks of rags in dealers' hands are fairly large. This obviously is so in view of the slow movement of supplies into consuming channels for some months, and also because certain grades of rags at today's prices offer much speculative inducement, the probabilities being all in favor of at least a slight rise in values when demand revives. At the same time, the average grader or packer is compelled to buy cautiously at present because most of them have stock bought at high prices which has absorbed the bulk of their capital to finance. At any rate, everything would seem to point to available supplies proving ample to cover paper manufacturers' requirements for quite a period ahead. Perhaps prices will advance somewhat when buying is resumed on a normal scale but mills should experience no difficulty in filling their wants.

Quotations on new cuttings have continued to ease gradually and show a considerable decline over the month. Roofing rags are between $3 and $4 per ton lower, and prices on old whites and blues have sagged.

Average quotations f. o. b. shipping points are as follows:

New Stock—	New York and Chicago
White shirt cuttings, No. 1	10.00-10.50
White shirt cuttings, No. 2	7.00- 7.50
Fancy shirt cuttings	6.50- 7.00
Washables, No. 1	5.00- 5.25
Unbleached muslins	8.00- 8.50
White lawns	9.50-10.00
Overall cuttings, blue	6.25- 6.50
Black silesias	3.75- 4.00
Old Stock—	
Whites, No. 1 repacked	5.75- 6.00
Whites, No. 2 repacked	3.50- 3.75
Whites, house soiled	1.50- 1.75
Whites, street soiled	1.25- 1.50
Thirds and blues, repacked	2.00- 2.25
Thirds and blues, rough	1.25- 1.50
Black stockings	2.20- 2.40
Lace curtains	5.25- 5.50
Cotton canvas, No. 1	3.75- 4.00
White cotton batting	1.75- 2.00
Roofing, No. 1	.75- .85
Roofing, No. 2	.65- .75

Rope and Bagging

Probably the most generally sought description of papermaking material at present is old rope. This is undoubtedly due in part to the small amounts of old rope that have been received recently from foreign sources, thus effecting a more or less scarcity of rope in the domestic trade, but proof is not wanting that consumers are absorbing comparatively good quantities of rope. The bulk of old manila rope of No. 1 quality moving toward paper mills is bringing about 4 cents per pound at shipping points. Slightly higher prices have been recorded paid in some instances, and it can be said that not many lots are to be had at less than 4 cents. Strings also meet with a fairly ready sale at around one cent per pound, or a trifle less.

The situation in old bagging is in direct contrast to that in old rope. Consumers evince scant buying interest, and the occasional purchases made are at very nearly buyers' own bidding figures. Prices on most grades have undergone further decline. F. o. b. shipping point quotations are:

	New York and Chicago
Gunny, No. 1 domestic	1.20-1.40
Gunny, No. 1 foreign	1.10-1.30
Scrap bagging, No. 1	.85-1.00
Roofing bagging	.55- .65
Wool tares, heavy	1.50-1.75
Wool tares, light	1.25-1.50
Manila rope, No. 1 foreign	3.75-4.00
Manila rope, No. 1 domestic	3.75-4.25
Sisal strings	1.75-2.00
Mixed strings	.90-1.15

Old Papers

Notwithstanding that recent developments have been of a nature that ordinarily would have a very bullish effect on most grades of waste paper, demand from consuming sources continues of such narrow scope that these factors have chiefly nothing more than a sentimental influence on the market. The strike of printers in various parts of the country would doubtless send prices on certain grades of old paper booming upward were demand anything like normal, while the shutting down of news print mills and pulp plants, and the almost country-wide decrease in collections of waste paper because of the low prices to be obtained for this material, would unquestionably serve to strengthen values if consumers were absorbing customary amounts of paper stock. Board and book mills and other of the principal users of waste paper, however, are buying in light volume, partly because they are getting wood pulp at proportionately low prices and partly because under present operating schedules they do not require usual tonnage of raw material, with the result the bullish factors mentioned

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Bleached and Unbleached
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CRAIG-BECKER COMPANY
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Domestic and Foreign Ground Wood and Sulphite

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The Pulp and Paper Trading Co.

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Dealers in Domestic Chemical and Mechanical Pulps and Paper

AGENTS FOR
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EASTERN AGENTS FOR
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Made by Port Huron Sulphite & Paper Co., Port Huron, Mich.

IMPORTED **TALC** DOMESTIC

We are also Headquarters for:

BLACKS
COLORS
FILLERS

BINNEY & SMITH CO.

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Bleached and Unbleached

WOOD PULP

of Every Description

M. GOTTESMAN & COMPANY

INCORPORATED

18 East 41st Street NEW YORK, N. Y.

Established 1886

above have had little influence other than in steadying the tone of prices.

Values of the bulky grades of old paper have sunk to levels where collectors, especially in the East, have greatly curtailed operations, but the reduced production of stock is scarcely noticed in a market where demand is not more than 50 per cent of normal. Sales of No. 1 mixed paper have been freely made in New York at $5 per ton, f. o. b. that city, while folded newspapers have sold in the East at $8 a ton and less, and No. 1 heavy books at $15 per ton. Shavings are down in price, as are kraft and manila papers. Prices on white blank news cuttings have steadied since the strike of news print mill operatives, and now range at around 1.40 cents a pound. Quotations f. o. b. shipping points follow:

	New York and Chicago
Hard white shavings, No. 1	2.75-3.00
Hard white shavings, Nos. 2-3	1.75-2.00
Soft white shavings	1.90-2.15
Colored shavings	1.00-1.25
Heavy book, No. 1	.80- .90
Crumpled No. 1	.65- .75
Ledger stock	1.75-2.00
Kraft, No. 1	1.50-1.60
Manilas, No. 1	.75- .85
White blank news	1.35-1.50
Overissue news, No. 1	.60- .65
Folded news	.40- .50
Mill wrappers	.60- .70
Box board cuttings	.35- 45
Mixed paper, No. 1	.25- .35
Common paper	.20- .25

Chemical Pulp

The strike of news print and pulp mill workers has somewhat changed the complexion of the chemical wood pulp market insofar as regards certain grades of pulp. Those mills affected by the strike are among the largest producers of unbleached sulphite and ground wood in the country, and ordinarily keep the various small paper and board plants who do not manufacture pulp supplied with these grades of fibre. With these supplies more or less removed from the market while producing mills are closed down, consumers who rely on such sources for pulp must necessarily look in other directions to buy sulphite and mechanical pulp, with the obvious result inquiry is on the rise.

Should the strike last for any appreciable length of time, there seems every reason to believe pulp prices would advance considerably. The whole situation at this writing rests on how long news print and pulp mills must remain idle. In the meantime, consumers as a general thing are as yet purchasing pulp in very cautious fashion, mostly limiting orders to supplies immediately required. There is still a surplus of nearly every kind of pulp in the market and until this surplus is absorbed, prices are likely to hold at around previous levels.

Leading producers of bleached sulphite in the United States and Canada are quoting 6.50 cents per pound at pulp mills for No. 1 bleached, yet sales have been recorded by other manufacturers at substantially lower prices, it being said that at least one domestic producer is offering bleached sulphite of good quality down to 5 cents. Quotations on news grade sulphite are a little firmer, 3.25 cents being about the minimum quoted, with a majority of manufacturers asking between 3.50 and 3.75 cents. Domestic No. 1 kraft pulp is available at around 3.50 cents and soda pulp at 5.75 to 6 cents at producing plants.

Quotations f. o. b. pulp mills follow:

Bleached sulphite	6.00-6.50
Easy bleaching sulphite	4.50-4.75
Unbleached sulphite No. 1	4.00-4.25
News grade sulphite	3.25-3.75
Soda pulp, bleached	5.75-6.00

STORM & BULL, Inc.
114 Liberty St., New York
EXPORT
All Grades of WRITING—BOOK—NEWS—WRAPPING
PAPERS
OFFERS SOLICITED

PAPER MAKERS'
Alum
(BOTH COMMERCIAL and FREE FROM IRON)
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ROBINS CONVEYING MACHINERY
The "Robins Hand Book of Conveyor Practice" will help you solve your conveying problems. Write for a copy.
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Get *Invincible* Prices on
Fresh Ground Wood Pulp
Bleached and Unbleached Sulphite
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BLEACHED AND UNBLEACHED
Agents for Kellner Partington Paper Pulp Co., Ltd.
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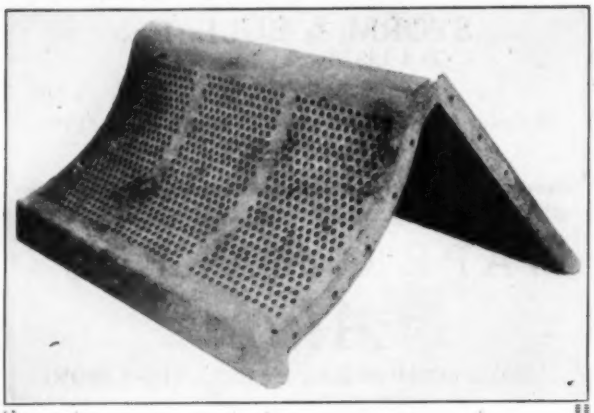
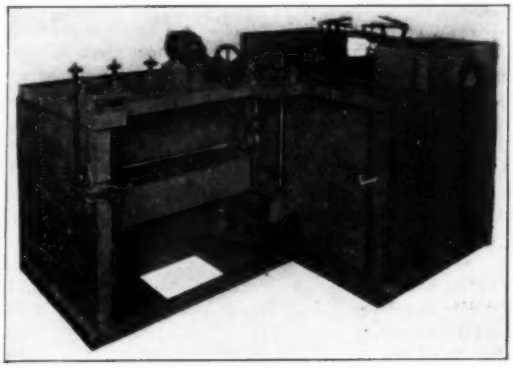


Because there are no moving parts this is a very simple but very efficient device. Patent No. 1,271,426 issued to Mr. Brownell Buehler, July 2nd, 1918.

The Shartle Continuous Beater Company
MIDDLETOWN, OHIO



TRIMBEY & ALLEN

The combination of the **Trimbey & Allen Automatic Continuous Mixing Machine** and the **Trimbey Automatic Consistency Regulator** gives:

1—Uniformity of product; saves power, labor, maintenance cost and floor space.

2—The use of the Trimbey & Allen Continuous Mixing System replaces the uncertain manual control of the proportions of the various paper making ingredients by an accurate mechanical control.

3—This means better running conditions on the machine and increased production of paper.

TRIMBEY & ALLEN
M. G. TIBBITTS, Sales Manager
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Rubber Covered Felt Rolls

DO YOU KNOW

That we cover Felt Rolls with Rubber that give better service than Brass Covered Rolls?

Our Rolls wear perfectly smooth. When once installed they require no further attention.

Write for names of satisfied customers using our rolls.

We Are Rubber Roll Specialists
Our Press Roll Stocks Are
the BEST on the Market.

The American Wringer Co.
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When it is a matter of

CHIPPER and BARKER KNIVES;
RAG CUTTER, ROTARY CUTTER and PAPER TRIMMING KNIVES,
FLY BARS and BED PLATES for BEATERS and WASHERS,
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JOHN W. BOLTON & SONS, Inc.
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Intensive specialists in the manufacture of uniformly high grade machine knives for the pulp, paper and board industry

Mitscherlich unbleached	4.75-5.00
Kraft No. 1	3.50-3.75
Screenings, refined	1.00-1.25

Mechanical Pulp

Since the closing down of news print and pulp mills on May 1 because of the strike of operatives in those plants, inquiry for ground wood has perceptibly increased. This is as was anticipated by most members of the pulp trade, who readily realize that the inability of those manufacturers involved by the strike to supply their customers compels the latter to seek pulp in other quarters. The tone of prices also has stiffened. Whereas before, offerings of at least limited-sized lots of ground wood were frequently reported at very low figures, at present most domestic producers are demanding around $35 per ton at pulp mills for prime spruce ground wood, while Canadian manufacturers are quoting mostly at a minimum of $30, which is equivalent to the higher price named by domestic mills when delivered to domestic consuming points and the extra freight is added.

There is as yet no scarcity of ground wood, but consumers apparently appreciate what might develop in the way of a shortage should the strike of pulp mill workers last very long, and the possibility of a shortage is attracting a good deal of speculative inquiry. Under a more normal demand and consumption, there is little doubt that values would undergo quick and broad enhancement in a situation such as exists at present in the producing end of the industry.

Chemicals

Current trade activity in papermaking chemicals involves chiefly the delivery of supplies on contract orders. Consumers are doing little new buying for the reason that stocks on hand and goods being delivered on contract prove ample to provide for present needs. Prices show no broad changes although the tendency in most cases continues downward. Quotations follow:

Alum, lump ammonia	4.00- 4.25
Alum, lump starch	7.50- 8.00
Alum, powdered	5.00- 5.50
Blanc fixe, powdered	3.75- 4.00
Bleaching powder (domestic drums)	2.75- 3.00
Brimstone (ton)	15.00-16.00
Casein	11.50-13.50
Caustic soda, spot delivery	3.40- 3.60
China clay, domestic washed	9.00-10.00
China, clay, foreign	13.00-16.00
Rosin, grade E	5.15-
Satin white	2.00- 2.25
Soda ash, 58 per cent light (bags)	2.00- 2.25
Sulphite of alumina, commercial grade	2.25- 2.50
Starch, papermakers', in bags	2.50- 2.75
Talc (ton)	16.00-18.00

England Asks Syracuse for Forest Specialists

England has just paid a handsome compliment to the New York State College of Forestry at Syracuse and to Dr. Harry P. Brown, Professor of Wood Technology, in that institution, by offering him the position of wood technologist in the Imperial Forest Research Institute, Dehra Dun, United Provinces, India. The offer to Dr. Brown came directly from the India Office, Whitehall, London, and was signed by Kershaw, Under Secretary of State of India.

During the seven years he has been connected with the College of Forestry, Dr. Brown has built up a strong department and has contributed many articles to scientific and technical journals on the structure of wood. He has recently completed a book entitled "Forest Trees of New York" which will shortly appear as a bulletin to be issued by the College.

After mature deliberation Dr. Brown has decided to decline the offer and remain with the College of Forestry.

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Detroit Chemical Works

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A PERFECT SUBSTITUTE FOR IRON FREE

We specialize in raw materials for the manufacture of all grades of paper and offer from stock:

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Casein Solvents

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"Wolverine" Waxed Papers for Every Requirement

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Waxed Tissue a Specialty

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Machine Finish and Super Calender White and Colored Book

Extra Machine Finish and Super Calender Litho

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New Papers

Writing—	
White rag	16-40
White sulphite, No. 1	12-20
Colored	14-22
Ledger—	
White rag	17-50
White sulphite	13-25
Colored sulphite	15-25
Colored rag	19-50
Bonds—	
White rag	12-40
White sulphite	11-20
Colored sulphite	13-24
Colored rag	14-40
Book—	
No. 1 S. & S. C.	9.50-10.50
Machine finished	7.50- 8.50
English finished	8.00- 9.00
Coated and enameled	11.00-12.00
Lithograph, M. F.	11.00-12.00
News Print—	
Rolls, contract	5.00- 5.50
Rolls, transient	5.50-
Sheets	6.00- 6.50
Side runs	4.00- 4.50
Cover Stock—	
Coated, both sides	9.25-
Coated, one side	9.20-
Wrappings—	
No. 1 kraft	6.50- 7.00
No. 2 kraft	6.00- 6.50
Boards—	New York and Chicago
Solid news	37.50-42.50
Straw	40.00-45.00
Plain chip	30.00-35.00
White coated chip	55.00-60.00
Manila coated chip	50.00-55.00
Binders board	75.00-85.00

Charles Boldt Paper Mills Sold

After negotiations of several weeks the Paepcke Paper Mills Company, Chicago, with a preliminary capitalization of $50,000 has bought the plant of the Charles Boldt Paper Mills Company, in Linwood, the consideration being in excess of $1,500,000, according to R. L. McClelland, who is the Vice President and Treasurer of the former corporation.

Elimination of the chip and liner board product from the plant, located in the eastern part of the city and concentrating the mill to the production of fiber and corrugated containers, is the plan of the new management.

The officials of the corporation are: President, Walter P. Paepcke; Vice President and Treasurer, R. L. McClelland; Secretary, E. A. Lang, and H. A. Hutchenson and Paul E. Duezeske, Directors, all being residents of Chicago.

The same interest control the Chicago Mill and Lumber Company of the Windy City.

In speaking of the purchase price Mr. McClelland stated it will be in excess of $1,500,000. He stated that the total capitalization of the Paepcke Paper Mills Company had not been determined. The real estate sold for $650,000.

This transaction in no way affects the Charles Boldt Glass Company, the latter being a separate corporation. At the present time Mr. Boldt, who was the principal owner of the paper mills, is constructing a straw board plant at New Iberia, in Louisiana. Heretofore straw board has been manufactured from wheat straw, and Mr. Boldt is experimenting with rice straw. The Southern plant, according to Fred W. Schwenck, secretary to Mr. Boldt, will be ready for operation in the fall.

Max Zimmerman, general manager of the Charles Boldt Paper Mills Co. since its organization, will stay with Mr. Boldt and act as general manager of the New Iberia plant. The mill will consist for the present of one two-cylinder paper machine to manufacture 9-point straw and egg case filler out of rice straw. The machine was furnished by the Beloit Iron Works; beaters by the Dayton Beater & Hoist Co.; engines by the Nordberg Mfg. Co., consisting of 1000 H. P. engine of the Uniflow type, direct connected with a Burke generator, and an additional unit of the Ball engine type direct connected to a Burke generator. The mill will be electrically equipped.

Several more machines is expected to be installed just as soon as proper arrangements can be made. The property is connected with two main railroads, Southern Pacific and New Iberia Northern, connecting with the Gulf Coast Lines, and a navigable stream is back of the mill, which will enable them to make shipments by water, this stream connecting with the Gulf of Mexico.

Champion Fibre Company Makes Generous Donation to Vocational Education Fund

The Champion Fibre Company of Canton, North Carolina, has for some time been taking a very prominent place among the leaders in the paper industry, who are affording opportunities for their men to qualify themselves through class work and study to become better workmen and better fitted for promotions to positions of greater responsibility.

At the recent Annual Meeting of the Technical Association of the Pulp and Paper Industry, the representatives of the Champion Fibre Company in attendance had an opportunity to learn in detail of the vocational education work being carried on by T. A. P. P. I., and examined the first two volumes of the series of five textbooks upon pulp and paper manufacture that are being published for widespread use throughout North America. When they were told that the Vocational Education Committee of the Technical Association still needs a balance of $7,500 to complete the work which has been going on for the past three years, the gentlemen representing the Champion Fibre Company promptly pledged $500 towards the undertaking, the receipt of which the Committee now acknowledges with great appreciation.

Work upon the editing and publishing of the textbooks is going steadily forward, and when completed they will afford the best means any industry in North America has yet given the men in it to qualify themselves for better workmanship and the occupation of positions of leadership.

The Farmers & Merchants National Bank of Benton Harbor, Mich., has been made receiver for the Mullen Bros. Paper Co., St. Joseph, Mich. The receiver was asked for by members of the company. The company is solvent and it would seem the move was directed against one of the other officers.

W. H. FURBISH, Vice-Pres. J. L. MUNRO, Treas.

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Chemical Pulp

Very little business is transpiring at present in foreign wood pulp. Papermakers in the United States are buying sparsely, because of the dullness in their own product, having no difficulty in covering requirements with domestic and Canadian pulps, while the high prices quoted by Scandinavian manufacturers serve to discourage most of the buying which probably would be engaged in under different circumstances. Importations are close to nil. As an example, arrivals from European sources at the port of New York during April totaled a bar several thousand bales, the bulk of which came from Finland. Importers are obviously disinclined to bring in pulp on their own account owing to the uncertainty surrounding the market and the stiff quotations named by producers on the other side, and the small shipments being received are almost entirely pulp purchased by paper mills some time ago for forward delivery.

Indications are that there is quite some supply of sulphite and kraft pulp imported within the last half year now held in store in the United States. Stocks are probably lighter than are normally carried, yet importers are frequently selling at sharp price concessions in order to rid themselves of holdings. In consequence, most of the sales of spot pulp reported from time to time are at prices far below current replacement costs as figured on the quotations ruling in primary markets. From authoritative reports, it is understood that stocks in Sweden and Norway are considerable less than mills there usually carry, while production at present is severely curtailed, and manufacturers apparently are awaiting the coming of summer and the opening up of the Baltic in anticipation of a better demand from America; in the meantime holding prices at levels where they stand little show in effecting sales in this country. Importers assert that the main reason for the high prices quoted by the Swedes is the continued high cost of production in that country, and some frankly say that Sweden can hardly hope to compete to any great extent in the American market during the coming year unless manufacturing costs decrease sufficiently to enable pulp producers there to sell at substantially lower prices.

Prices at present are very irregular and on a broad range. When asked to quote on pulp for future shipment from the other side, importers name figures far above those at which sales of spot pulp are recorded. At least some lots of bleached sulphite of No. 1 quality have sold on spot at 6 cents per pound, while easy bleaching sulphite has sold down to 4.75 cents, No. 1 unbleached sulphite at 4.25 cents and Scandinavian kraft at 3.50 cents. Reports have been heard of transactions involving so-called distress lots of pulp at even less than these prices.

Arrivals at New York in April and nominal current spot market quotations follow:

Bleached sulphite	$ 6.00- 6.50
Unbleached sulphite, No. 1	4.25- 4.50
Easy bleaching	4.75- 5.00
Mitscherlich unbleached	4.00- 4.50
Kraft	3.50- 3.75
Ground wood, per ton	30.00-35.00

Lagerloef Trading Co., 3,054 bls. from Hango; National Bank of Commerce, 1,400 bls. from Gothenburg; Order, 351 bls. from Danzig.

Paper Stock

The light receipts of papermaking material from foreign sources in the past few weeks clearly reflect the dull demand for such goods in this country. Paper mills in the United States are having no difficulty in securing all the raw stock needed under present operating schedules from domestic quarters, thus limiting demand for imported material, while prices on most kinds of papermaking stock have declined to a point where there is scarcely any profit in bringing supplies in from abroad, with the result, importers are confining their buying at primary sources almost entirely to goods required to fill direct orders from consumers.

Most of the rags now coming in are roofing stock, and importers say these supplies represent goods purchased some time back. Only a few shipments of old rope and bagging were received last month, and these, it is understood, also were on old orders. Advices are to the effect that fairly large accumulations of papermaking rags exist in the different European countries, but merchants on the other side are said to be unwilling to sell at the prices now obtainable in the American market. Papermakers appear to realize that they should have no difficulty in acquiring all the raw material wanted in Europe over the next few months, provided they are satisfied to meet the prices asked, and are at present purchasing only when the goods offered represent such a low cost as to warrant them taking in the material.

Arrivals of paper stock at the port of New York in April follow:

Old Rope

International Purchasing Co., 78 bls. from Havre; Brown Bros. & Co., 17 coils from Bristol and 176 coils from Hull; W. H. Cummings & Sons, 153 bls. from Copenhagen; Maurice O'Meara Co., 93 bls. from Stockholm; W. Schall & Co., 60 bls. from Barcelona; Edwin Butterworth & Co., 63 coils from Antwerp.

Old Bagging

Edwin Butterworth & Co., 111 bls. from Havre, 128 bls. from Antwerp and 123 bls. from Rotterdam; British Bank of South America, 94 bls. from Liverpool; Equitable Trust Co., 91 bls. from Havre; Order, 409 bls. from Hamburg.

Rags

Castle, Gottheil & Overton, 198 bls. from Bordeaux and 156 bls. from Genoa; Leshner Paper Stock Co., 293 bls. from London; Edwin Butterworth & Co., 940 bls. from Antwerp; Salomon Bros. & Co., 294 bls. from Hamburg; American Woodpulp Corp., 1,868 bls. from Hamburg; Ladenburg, Thalman & Co., 105 bls. from Hamburg; Merchanics & Metals National Bank, 295 bls. from Algiers; Agencie Cie. General Trans., 449 bls. from Havre; Paul Berlowitz, 445 bls. from Havre; Train, Smith & Co., 257 bls. from Antwerp; Royal Mfg. Co., 182 bls. from Genoa; W. Hughes & Co., 57 bls. from Rotterdam; Dallas Waste Mills, 121 bls. from Rotterdam; G. Mathes Co., 148 bls. from Rotterdam; R. F. Downing & Co., 18 bls. from Rotterdam; Equitable Trust Co., 65 bls. from Glasgow and 183 bls. from Antwerp; Bank of New York, 61 bls. from Havre; Order, 700 bls. from Havre, 638 bls. from London and 210 bls. from Hamburg.

Miscellaneous Paper Stock

Guaranty Trust Co., 34 bls. from Glasgow; Edwin Butterworth & Co., 479 bls. from Antwerp; Maurice O'Meara Co.,

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277 bls. from Antwerp; First National Bank of Boston, 180 bls. from Antwerp.

Paper

In keeping with the general slowing up of the foreign trade of the United States in various commodities, importations of finished paper have declined recently. Receipts of paper from foreign countries at New York in April were substantially of smaller volume than for some months previous; as an instance, imports of news print amounted to but around 14,000 rolls as compared with approximately 30,000 rolls brought in through the port of New York in March and 24,000 rolls in February. The usual shipments of cigarette papers from France arrived last month, and there were fair-sized quantities of hanging, wrapping and filter papers received. Imports of board also showed a considerable decrease from previous months' arrivals. Paper imports at the port of New York in April follow:

Cigarette

Rose & Frank Co., 230 cs. from Havre; Surbrug Co., 24 cs. from Havre; Wilkinson Bros. & Co., 5 cs. from Havre; United Fruit Co., 50 pkgs. from Barcelona; R. J. Reynolds Tobacco Co., 1,660 cs. from Bordeaux; American Tobacco Co., 1,620 cs. from Bordeaux and 226 cs. from Havre; J. Victori & Co., 5 cs. from Barcelona; J. B. Warass, 2 cs. from Antwerp; Order, 28 cs. from Havre.

Printing

First Federal Banking Corp., 2,128 rolls from Hango; National City Bank, 1,189 rolls from Hango and 550 rolls from Gothenburg; National Bank of Commerce, 1,106 rolls from Rotterdam; L. A. Consmiller, 5 cs. from Rotterdam; Guaranty Trust Co., 254 rolls from Hamburg; Gerhard & Hey, 5 cs. from Hamburg; Kupfer Bros. Co., 19 cs. from Rotterdam; B. F. Drakenfeld & Co., 42 cs. from Liverpool; Oxford University Press, 33 cs. from Liverpool; Chatham & Phenix National Bank, 297 rolls from Hamburg; Chemical National Bank, 237 rolls from Christiania; Globe Shipping Co., 102 cs. from Hamburg; J. & J. Scott, Ltd., 13 bls. from Antwerp; R. F. Lang, 931 rolls from Hamburg; New York American, 4,551 rolls from Gothenburg; C. A. Johnson & Co., 28 bls. from Liverpool; Order, 294 rolls from Stockholm, 158 rolls from Hango and 1,728 rolls from Norrkoping.

Wrapping

First National Bank of Chicago, 106 cs. from Hamburg; Republic Bag & Paper Co., 775 rolls from Hamburg; L. H. Myers & Son, 8 bls. from Gothenburg; Prager Co., 266 pkgs. from Antwerp.

Hanging

W. H. S. Lloyd & Co., 37 pkgs. from London; Prager Co., 2,287 pggs. from Antwerp; A. C. Dodman, 18 bls. from Liverpool; Bech, Van Siclen & Co., 4 cs. from Kobe; R. F. Downing & Co., 5 cs. from London; Order, 3 cs. from Gothenburg.

Writing

Globe Shipping Co., 19 pkgs. from Havre; Defiance Mfg. Co., 23 cs. from Marseilles; Goodman & Levy, 3 cs. from Havre; Meadows, Wye & Co., 4 cs. from Liverpool; A. C. Fetterolf, 29 cs. from Liverpool; Order, 27 cs. from Antwerp, 1 cs. from London and 9 cs. from Rotterdam.

Drawing

Lunham & Moore, 17 cs. from London; Canton & Montgolfer, 6 cs. from Havre; Keuffel & Esser Co., 45 cs. and 227 rolls from Hamburg; L. A. Consmiller, 2 cs. from Rotterdam.

Tissue

H. Reeve Angell & Co., 21 cs. from Hango; Columbia Ribbon & Carbon Mfg. Co., 12 cs. from Hango; Mittage & Volger, 10 cs. from Hango; Ault & Wiborg, 2 cs. from Hango; R. Hoe & Co., 14 bls. from London; Meadows, Wye & Co., 12 cs. from

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Wood Splitters	Chip Screens	Plug Machines
Pulp Grinders	Sulphur Burners	Bronze and Lead Work

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Carthage New York

Liverpool; Wilkinson Bros. & Co., 16 cs. from Liverpool; Order, 30 bls. from Hamburg.

Filter

E. Fougera & Co., 28 cs. from Bordeaux; Orbis Products Trading Co., 8 bls. from Bordeaux; Lunham & Moore, 16 cs. from London; Zinkeisen & Co., 17 bls. from Hamburg; Bernard, Judae & Co., 48 bls. from Bordeaux; Druggist Supply Corp., 22 cs. from Bordeaux.

Boards

Lagerloef Trading Co., 30 bls. from Hango; American Express Co., 10 pkgs. from London and 3 cs. from Hamburg; J. C. Murray & Co., 2 cs. from Southampton; H. Reeve Angell & Co., 2 bls. from Hamburg; J. Schmidt, 6 cs. from Hamburg; J. J. Nolan, 2 rolls from Antwerp; Prager Co., 63 cs. from Antwerp; Irving National Bank, 172 rolls from Hamburg; C. B. Hewitt & Bros., 8 bls. from Gothenburg; U. S. Forwarding Co., 43 cs. from Hamburg; Wilkinson Bros. & Co., 25 rolls from Gothenburg; Lincoln Trust Co., 116 rolls from Rotterdam; Metropolitan Import & Mfg. Co., 38 cs. from Hamburg.

Miscellaneous

F. B. Vandegrift & Co., 8 cs. from Havre; H. D. Catty & Co., 25 cs. from Havre; Lunham & Moore, 23 cs. from London; A. Bourjois & Co., 68 cs. from Bordeaux and 26 cs. from Havre; Transatlantic Shipping Co., 2 cs. from Hamburg; R. F. Lang, 39 cs. from Hamburg; New York Label & Box Works, 5 cs. from Rotterdam; A. G. Ringk & Co., 64 cs. from Hamburg; E. Dietzgen & Co., 11 cs. from Hamburg and 16 cs. from Marseilles; Guaranty Trust Co., 40 cs. from Antwerp; Bernard, Judae & Co., 12 pkgs. from Hamburg; H. Reeve Angell & Co., 2 cs. from London and 4 cs. from Stockholm; Tice & Lynch, 2 cs. from Havre and 9 cs. from Liverpool; S. Vandewark, 6 cs. from Havre; A. Constable & Co., 2 cs. from Havre; H. Lips, 29 cs. from Marseilles; B. Meiners, 25 cs. from Hong Kong; P. O. O'Brien, 5 cs. from Hamburg; Irving National Bank, 2 cs. from Hamburg and 3 cs. from Southampton; U. S. Forwarding Co., 23 cs. from Hamburg; Japan Paper Co., 15 cs. from Kobe, 21 cs. from Havre, 108 cs. from Genoa and 8 cs. from London; E. H. Potter & Co., 10 rolls from Vancouver; Heule Wax Paper Mfg. Co., 2 cs. from Southampton and 2 cs. from Havre; Louis Dejong & Co., 1 cs. from Southampton; Baldwin Shipping Co., 16 cs. from Hamburg; R. F. Downing & Co., 10 cs. from Havre; Canton & Montgolfer, 9 cs. from Havre; T. L. N. Smythe Co., 2 cs. from Hamburg; Berger & Werth, 5 cs. from Hamburg; Hensel, Bruckmann & Lorbacher, 16 cs. from Hamburg; Globe Shipping Co., 3 cs. from Havre; Henry Lindenmeyr & Sons, 35 cs. from Hamburg and 36 bls. from Rotterdam; L. A. Consmiller, 31 cs. from Rotterdam; Havana Trading Co., 1,500 cs. from Marseilles; W. A. Foster & Co., 6 cs. from Hamburg; Goodman & Levy, 2 cs. from Havre; Tamm & Co., 19 cs. from Rotterdam; L. Frey, 2 cs. from Rotterdam; Favor, Ruhl & Co., 6 cs. from Gothenburg; Order, 3 cs. from Havre, 13 cs. from London, 2 cs. from Hamburg and 5 cs. from Canton.

Foreign Trade Opportunities

A firm of commission merchants in Porto Rico desires to be placed in communication with exporters of wrapping paper and other products. No reference offered. For further data those interested should communicate with the Bureau of Foreign and Domestic Commerce, referring to Inquiry No. 34,772.

A mercantile firm in Austria desires to purchase caustic soda, sulphite of copper, acetic acid to 80 per cent, soda crystals, and soda ash. Shipments to be made by steamship from Galveston, Tex., to Trieste. Quotations should be given c. i. f. to destination. Reference. For further data those interested should communicate with the Bureau of Foreign and Domestic Commerce, Washington, D. C., referring to Inquiry No. 34,672.

An inquiry has been received from a man in Canada for the

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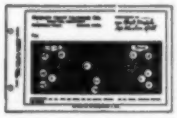

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purchase of a well known make of paper building board. Quotations should be given f. o. b. port of shipment. Transportation by railroad. Cash to be paid. Reference. For further data those interested should communicate with the Bureau of Foreign and Domestic Commerce, Washington, D. C., referring to Inquiry No. 34,668.

A trading company in Australia desires to purchase building paper and paper of other kinds. Quotations should be given c. i. f. Sidney and f. o. b. New York. References. For further data those interested should communicate with the Bureau of Foreign and Domestic Commerce, Washington, D. C., referring to Inquiry No. 34,666.

A mercantile firm in Australia desires to purchase or secure an agency for the sale of casein. References. For further data those interested should communicate with the Bureau of Foreign and Domestic Commerce, Washington, D. C., referring to Inquiry No. 34,655.

A merchant in Spain desires to be placed in communication with an exporter of wood pulp, with a view to securing his representation in that market. No reference offered. For further data those interested should communicate with the Bureau of Foreign and Domestic Commerce, Washington, D. C., referring to Inquiry No. 34,657.

A mercantile firm in Canada desires to purchase wall board. Quotations should be given f. o. b. port of shipment. Shipments should be made all rail. Reference. For further data those interested should communicate with the Bureau of Foreign and Domestic Commerce, Washington, D. C., referring to Inquiry No. 34,692.

A builder in Mexico desires to purchase wall paper. Quotations should be given c. i. f. Mexico. No reference offered. For further data those interested should communicate with the Bureau of Foreign and Domestic Commerce, Washington, D. C., referring to Inquiry No. 34,698.

A book store in North China desires to purchase pads and paper. References. For further data those interested should communicate with the Bureau of Foreign and Domestic Commerce, Washington, D. C., referring to Inquiry No. 34,587.

A merchant in Spain desires to purchase paper plates and trays for butter, etc. Quotations should be given c. i. f. Spanish port. Terms, cash against documents. Correspondence should be made in Spanish. References. For further data those interested should communicate with the Bureau of Foreign and Domestic Commerce, Washington, D. C., referring to Inquiry No. 34,594.

A mercantile firm in India desires to secure exclusive agencies for the sale of paper and paper products. No reference offered. For further data those interested should communicate with the Bureau of Foreign and Domestic Commerce, Washington, D. C., referring to Inquiry No. 34,757.

A commercial agent from Mexico who is in the United States wishes to secure an agency for the sale of paper. References. For further data those interested should communicate with the Bureau of Foreign and Domestic Commerce, Washington, D. C., referring to Inquiry No. 34,753.

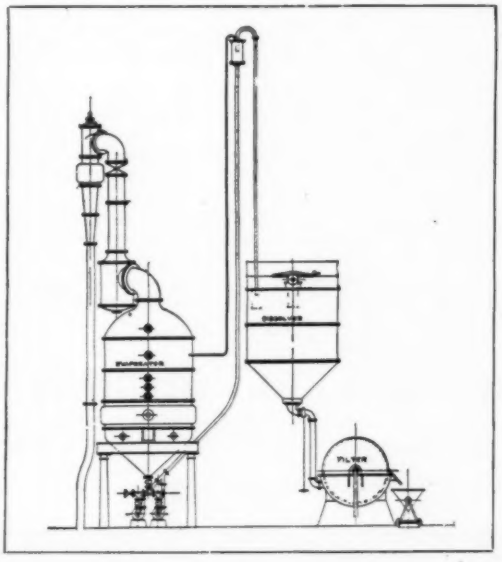
A mercantile firm in Belgium desires to secure representation for the sale of paper. No reference offered. For further data those interested should communicate with the Bureau of Foreign and Domestic Commerce, Washington, D. C., referring to Inquiry No. 34,725.

Apparatus for Continuous Removal, Filtering and Washing of Precipitated Salts from Evaporators

Particularly desirable for use in connection with diaphram cells

THIS apparatus, backed by a number of years of successful service, is intended to make what is now generally an intermittent operation continuous, and in a large sense automatic. Moreover, the apparatus is of a character requiring no more attention than can be given it by the man in charge of the evaporator. In other words, it can be operated without extra labor.

One of the most important features is that it permits continuous operation of evaporators

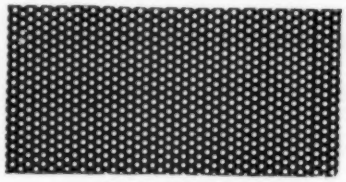


without periodic drawing off and refilling, consequently it contributes to minimum steam consumption by doing away with the intermittent cooling and reheating of batch charges as drawn into the evaporators.

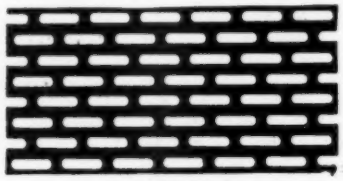
Glamorgan Pipe & Foundry Co.

Lynchburg, Va., U. S. A.

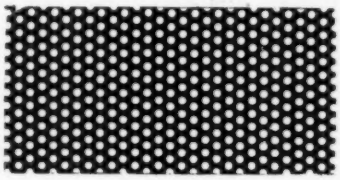
Perforated Metal Screens for Pulp and Paper Mills



.065 inch round



⅛ x ½" Slots



3/32 inch round

Steel, Copper, Brass, Bronze and other alloys punched for Centrifugal and Rotary Screens, Pulp Washers, Drainer Bottoms, Filter Plates, etc.

CHARLES MUNDT & SONS 57-65 Fairmount Avenue, Jersey City, N. J.

Gibbs-Brower Bulletin

Mills For Sale

FOLDING BOX BOARD MILL—12-cylinder machine, 65" trim, water power and electricity, 20 tons production. Also ground wood mill—20 tons production.

HIGH GRADE SPECIALTY BOARD MILL—5-cylinder machine, 65" trim, steam and electricity, 20 tons construction. Also ground wood mill—15 tons production.

HARDWARE, TEXTILE and COLORED SPECIALTY MILL—Three-cylinder machine, 52" trim, water, steam and electricity; 6 tons production.

KRAFT and SULPHITE WRAPPING MILL—Fourdrinier machine trimming 61", steam; 10 tons production.

NEWS PRINT MILL—Fourdrinier machine trimming 72", water and steam, 15 tons production. Also ground wood mill 6 tons production.

LIGHT TISSUE & CREPE TOWEL MILL—54" cylinder and 76" Fourdrinier machines, excellent water power and electricity; 7 tons production.

BOOK MILL—Fourdrinier Machine trimming 78", water and steam, 6 tons production. Also dry ground wood mill—6 tons production.

BOND WRITING & LEDGER MILL—Fourdrinier machine trimming 68", electricity and steam, 10 tons production.

BINDERS', FRICTION AND PATTERN BOARD MILL—60" wet machine, water and steam, four tons production.

ROOFING, SATURATING AND DEADENING FELTS MILL—44" single cylinder machine, water and steam, eight tons production.

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In order to do this we must have greatly increased manufacturing and trading facilities.

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